JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

APRIL, 1856.

CIVIL ENGINEERING.

*On the Railways and Telegraphs of Great Britain.** Address of ROBERT STEPHENSON, Esq., President of the Institution of Civil Engineers, January 8th, 1856.

After a complimentary allusion to the addresses of his predecessors, the President observed, that he would apply himself to the great question of British Railways, which were described as spreading like a network over Great Britain and Ireland, to the extent of 8054 miles completed ;—thus, in length, they exceeded the ten chief rivers of Europe united, and more than enough of single rails were laid to make a belt of iron around the globe.

The cost of these lines had been £286,000,000,—equal to one-third of the amount of the national debt.

The extent of the railway works was remarkable ;—they had penetrated the earth with tunnels to the extent of more than fifty miles ; there were 11 miles of viaduct in the vicinity of the metropolis alone ;—the earth works measured 550,000,000 of cubic yards.

Eighty millions of train miles were run annually on the railways ; 5000 engines and 150,000 vehicles composed the working stock ; and the companies employed 90,400 officers and servants ; whilst the engines consumed annually 2,000,000 tons of coals ; so that in every minute of time 4 tons of coal flashed into steam 20 tons of water. The coal consumed was almost equal to the whole amount exported to foreign countries, and to one-half of the annual consumption of London.

In 1854, 111 millions of passengers were conveyed on railway ; each passenger traveling an average of 12 miles. The old coaches carried an

* From Newton's Lond. Journ., Feb., 1856.

average of 10 passengers; and for the conveyance of 300,000 passengers a day 12 miles each, there would have been required at least 10,000 coaches and 120,000 horses.

The receipts of the railways in 1854, amounted to £20,215,000; and there was no instance on record in which the receipts of a railway had not been of continuous growth, even where portions of its traffic had been abstracted by the competition of new lines.

The wear and tear was great; 20,000 tons of iron required to be replaced annually; and 26 millions of sleepers annually perished; 300,000 trees were annually felled to make good the loss of sleepers; and 300,000 trees could be grown on little less than 5000 acres of forest-land. The President considered, at some length, how these annual depreciations should be met. The principle of a renewal fund was questionable. After a certain period in the history of every railway, deterioration reached an annual average, and as that annual depreciation became a charge, as fixed and certain as the cost of fuel, or the salaries of officers, it should be admitted as an annual charge against receipts.

As regarded fares, the interests of the companies and of the public were identical: companies must regulate fares, by consideration of the circumstances which produced the largest revenue, and the circumstances which produced the largest revenue were those which induced the greatest number of individuals to travel. Nothing was so profitable as passenger traffic, as it cost less, in every way, than goods, and an average train would carry 200 passengers. The cost of running a train was over stated at 15 pence per mile; and 100 passengers at five-eighths of a penny per mile produced 5*s.* 2½*d.* But this argument did not imply that, in all cases, fares should be fixed at a minimum. Minimum fares were most profitable on short routes; but the public were too much occupied, to be tempted by minimum fares to undertake long journeys. High rates of speed and increased comforts were then required, and these might be charged for. Every case, therefore, should be treated in consideration of its local circumstances.

The postal facilities afforded by railways were very great. But for their existence, Mr. Rowland Hill's plan never could have been effectually carried out. Railways afforded the means of carrying bulk, which would have been fatal to the old mail coaches. Every Friday night, at present, when the weekly papers were transmitted, 8 or 10 vans were now required for post-office bags on the North Western Railway, and this use of 8 or 10 railway vans implied, at the least, the employment of 14 or 15 mail coaches; and the expenses of 14 or 15 mail coaches to Birmingham, could never have been sustained by a penny postage. For this great blessing, therefore, the nation had to thank the railways. They were the great engines for the diffusion of knowledge. The Parliamentary blue books never would have been printed; for except by canal, or by wagon, they could not have been distributed; and if they could not have been circulated, they would have been useless. Nevertheless, the post-office did not appear to treat railways with all the consideration they were entitled to expect. Great services were required, and in return, it had been contended, that no profit should be allowed to the railway companies, except as carriers and workers of the line.

Railway companies were, therefore, indifferent to postal traffic; and this was shown to be a serious disadvantage to the public. At present the post-office competed with railways, as carriers of book parcels, a principle which might be extended still further, but not without injustice and hardship to the railways.

Parliamentary legislation for railways was full of incongruities and absurdities, which were graphically described and illustrated. The Acts of Parliament which railways had been forced to obtain, had cost the public fourteen millions sterling. But this was shown to be the exclusive fault of Parliament itself, and of the system it enforced. The legislation of Parliament had made railways pay 70 millions of money to land-owners for land and property; yet almost every estate traversed by railway had been greatly improved in value. Parliament had taxed the Companies in favor of the land-owners for what was called "severance." Claims for compensation for severance were based on theories which were wholly ideal and imaginary. No one had ever been able to show a practical loss by severance; and the claim was often made as customary, where it was even admitted that no ground for it existed. The remedy which suggested itself for this state of things, was a competent tribunal, which Parliament was not likely to grant. If a mixed commission could be organized, to consist of practical men of acknowledged legal, commercial, and mechanical ability, there might be some chance of railway business being efficiently conducted. But it was admitted that there was little hope of any such concession.

Railway management was next considered, and shown to be completely anomalous. Parliament had legislated for railways as toll-taking companies; but every direction was obliged to embark in enterprises foreign to the parliamentary objects of the railway itself. This produced serious dilemmas. As long as dividends were kept up, the Directors were popular, however illegal their acts; but the moment dividends fell, the Directors, however energetic, wise, or prudent, were visited by the shareholders and the public with all the penalties of having exceeded the letter of the law. Men, whose reputations were at stake, were consequently unwilling to incur the risk of becoming railway directors; and the most enlightened managers and shareholders were revolving in their own minds how the dilemma could be escaped. It was suggested, that advantage might be taken of the Limited Liability Act, or of some analogous measure, to enable a limited number of men of business to take lines of railway from shareholders on leases, subject to certain conditions and terms. A few of the lessees would then constitute themselves managers; and being free from apprehensions on account of shareholders, of external interference, or of personal liabilities, they would be able fully to work the line, and enter into those enterprises necessary for its development, and essential to its prosperity. A large profit would accrue to those who took the line, and managed it with vigor and economy; whilst shareholders would derive great advantages from the certainty of receiving fixed dividends, and from the enhancement of the value of their property; and practical security would be afforded to the public, whilst their best interests would be consulted.

The Electric Telegraph—that offspring and indispensable companion

of railways—was next considered. 7200 miles of telegraph, or 36,000 miles of wires, at least, were laid down. 3000 people were continually employed, and more than a million of public messages were annually flashed along this "silent highway." To the working of railways, the telegraph had become essential. The needle was capable of indicating, at every station, whether the line was clear or blocked, or if accident had any where occurred. The telegraph could, therefore, do the work of additional rails, by imparting instantaneous information to the officers, and enabling them to augment the traffic over those portions of the line to which their duty might apply. It also enabled large savings to be effected in rolling stock, by affording the means of supplying such stock to any station at which it was needed, from some other station where it had accumulated and was not wanted. The mode in which this system was worked was described, and its simplicity was commended. As a perpetual current was passing through the wires, the guard, or engine driver, had only to break the train-wire in case of accident, and the officers at the nearest station were instantaneously apprized that something was wrong, and that assistance was needed. Statistics were given, to show that the business of the Electric Telegraph Company had increased fifty-fold in seven years.

Railway accidents occurred to passengers, in the first half of 1854, in the proportion of one accident to every 7,195,343 travelers. Ladies and gentlemen could scarcely "sit at home at ease" with the impunity with which, it appeared, that they could travel by railway. How frequent, comparatively, were the accidents in the street; how fearful the misadventures to those "who go down to the sea in ships." Yet Parliament had seen fit to legislate expressly for accidents by railways, without legislating in the same way for accidents from other sorts of locomotion. This was unfair to railways, and ill-calculated to afford protection to the public where it was most needed. Lord Campbell's Act, also, measured men's lives by a class standard. The family of a high public functionary would get large compensation, whilst the family of the poor working-man would get nothing. The practical tendency of this law was to retard the adoption of low fares. Railway managers were compelled to consider, not only what they might gain, but what they might lose; and the larger the number of passengers, the greater the risk of accident to some one of them. The companies were, practically, obliged to insure the life of every person who traveled on their line, without being able to apportion the premiums to the risks incurred.

The results of railways were astounding: 90,000 men were employed directly, and upwards of 40,000 collaterally;—130,000 men with their wives and families, represented a population of 500,000 souls; so that 1 in 50 of the entire population of the kingdom might be said to be dependent upon railways. To the public "time is money," and, in point of time, an enormous saving was effected; for on every journey averaging 12 miles in length, an hour was saved to 111 millions of passengers per annum, which was equal to 38,000 years in the life of a man, working eight hours a day; and allowing an average of 3*s.* per diem for his work; this additional saving was £2,000,000 a year. The moral results of railways were equally remarkable: railways were equalizing the value

of land throughout the kingdom, by bringing distant properties practically nearer to the centre of consumption, and by facilitating the transit of manures; thus enabling poor lands to compete with superior soils. The stimulus afforded to national industry was exemplified, by the progress of the boiler-plate manufacture; and the increased comforts afforded to the people were illustrated by the extraordinary progress of the fish trade, and the development of the inland coal traffic. It was observed, that before railways existed, internal communication was restricted by physical circumstances: the canal traffic was dependent on the supply of water at the summit levels, and upon the vicissitudes of seasons of either drought or frost. Railway communication was free from all these difficulties, and every obstacle that nature had opposed, science had hitherto effectually surmounted.

The address concluded with some words of practical application. The duty devolved on Civil Engineers, of improving and perfecting this vast system. Every farthing saved, on the train mileage of the kingdom, was £80,000 a year gained to Railway Companies. There was, therefore, ample field for economical appliances, and therefore no economical arrangement, however trifling, was to be neglected. Nothing would afford the President greater satisfaction than that from his observations some sound practical improvement should result to a system with which his name, in consequence of his father's works, had been so largely associated; for however extensive his own connexion with railways, all he had known, and all he had himself done, was due to the parent whose memory he cherished and revered.

---

*Remarks on Floating and Fixed Lighthouses.** By David Stevenson, F.R.S.E., M.Inst. C. E.

Sir—At the meetings of the Institution of Civil Engineers held on the 13th and 20th of November, at which I was not present, Mr. George Herbert's proposals for constructing Floating Lighthouses were read and discussed. I find from the Transactions, that on that occasion it was stated that the important objects fulfilled by the Eddystone, the Bell Rock, and the Skerryvore lighthouses, could be attained by means of a floating tower, with equal efficiency, and at a cost greatly inferior to the amount expended on these national works; and in proof of this, the actual cost of these three lighthouses was compared with the *estimated* cost of towers constructed on the new principle. These important sea lights having been thus specially and publicly referred to, I feel that no apology is necessary on my part for taking this mode of vindicating the proceedings of the Boards under whose auspices they were erected, as it can be satisfactorily shown that the objects which they serve could not be obtained in the manner proposed, and, therefore, no comparison of cost, such as has been made in the Transactions of the Institution of Civil Engineers, can in reality be justly or fairly instituted. Mr. Herbert's

*From the Lond. Civ. Eng. and Arch'a. Jour., Jan., 1856.

own wish in the matter, as expressed to me, is, that the subject should be fully canvassed.

I do not propose to discuss the important mechanical and nautical question, which is at once suggested by the difficulties to be encountered in maintaining in its site a circular body 80 feet in diameter, and 130 feet in height, moored on the foul and rocky bottom which surrounds the Eddystone, the Skerryvore, or the Bell Rock, amidst the seas to which it would, in any of these situations, be exposed. On this point I shall only say, that in dealing with floating bodies of such size and form, it is possible that even the resources of engineering, which seem to be regarded in the present day as boundless, may be found to have very marked limits prescribed to them, by the formidable and subtle elements of wind and sea, with which, in the case in question, they have to contend. But, in my opinion, such a discussion is altogether unnecessary, because, were the scheme proposed by Mr. Herbert feasible and advisable—which I am not prepared to admit,—it is not difficult to show that, in point of fact, the important objects now fulfilled by the lighthouse towers on these rocks, would not be obtained by means of the proposed floating tower, even if it could be successfully moored and maintained in its position.

It may be regarded as an axiom in lighthouse engineering, that a light exhibited from a *fixed* tower is preferable to one from a *light-ship*, and that a *fixed* beacon or perch is preferable to a *buoy*. No one who knows the subject will deny that a danger can be marked more precisely and advantageously by a sea-mark placed *upon* it, than by a mark moored *off* it; or that a more effective lighting apparatus can be adopted in a *fixed* tower than in a light-ship; or further, that while all lights or sea-marks exhibited from fixed structures may be regarded as *absolutely safe and certain in their exhibition*, all light-ships or buoys are the reverse of this, for their liability to drag their moorings and break adrift is notorious, and the danger to the shipping arising therefrom is very great.

Although, therefore, light-ships and buoys ought never to be adopted where it can be avoided, still, it is at once admitted that there are situations where the difficulty of obtaining a foundation for a fixed structure renders their adoption absolutely necessary; and it cannot be doubted that all endeavors to improve the construction of light-ships and buoys should receive every consideration. This important subject has not escaped notice, for various efforts have been made, from time to time, to improve these sea-marks; and in 1851, Prof. Babbage, in his "Notes on Lighthouses," proposes to light up floating buoys, and in order to procure greater steadiness and safety, suggests that "the buoys should be attached to their moorings by rings fixed at the centre of resistance." But, with every perfection of construction and mooring, the proposition to place a *floating* and a *fixed* light in the same category, and to represent that the one is "as efficient" as the other, cannot be conceded; and this untenable proposition is laid down in the Transactions alluded to, where it is asserted that the sites of the Eddystone, Bell Rock, and Skerryvore might be as "efficiently" marked by the floating-light as by the present lighthouse towers; and the announcement is made that "practical men now seemed to think that the old system should not be con-

tinued, as the sea light-tower is capable of being moored in any depth of water."

In order to show that this proposition cannot be substantiated, I shall, in the first place, remark that a fixed tower such as that erected on the Bell Rock, the Eddystone, or Skerryvore, admits of the adoption of the most perfect apparatus which the engineer, with the combined application of scientific optical research and practical mechanics, can produce; the grand object being to intercept every ray of light, and to project a beam, unvarying in its characteristic appearance, towards the eye of the mariner. But no such advantage can attend the exhibition of a light from a floating tower, as its motion would render impossible the advantageous adoption of the most approved methods of illumination now used in lighthouses.

I may here remark, that from the observations I have made upon one of Mr. Herbert's buoys, which is moored in the Firth of Forth, I have reason to believe that the oscillation of the proposed light-tower will be much more appreciable than he anticipates. Mr. Herbert estimates that the pressure of the wind acting on the tower will cause it to incline 1° 28′ from the perpendicular. This can be determined by experiment only, but if in this estimate the action of the wind is viewed as a statical pressure, without regard being paid to the momentum of the moving tower; and, moreover, if, in addition to this (as I infer from the statement made to be the case), the action of the sea has not been taken into account, I should venture with confidence to predict, notwithstanding the peculiar form of the submerged base of the tower, that the united action of wind and sea, during storms, will produce a *cumulative* effect, and give the tower so great an inclination, as occasionally to take the light altogether out of the view of an observer at the horizon. The destructive result of this will be that, instead of a light with a decided and unvarying characteristic appearance, such as "stationary," or "revolving," or "flashing," being exhibited, we shall have a light altering its character with every heavy gale, when it is of most importance that it should not be mistaken.

In addition to this oscillation, there will undoubtedly be more or less of a rotary or spinning motion of the tower round its axis, which is fatal to the adoption of "revolving" or "flashing" lights in floating towers, and thus in these important situations the advantages of the much greater power of revolving lights, as compared with those which are fixed, could not be secured. To insure the effective working of the delicate machinery connected with the revolving apparatus, and the lamps of a first-class light in a light-room, moving to and fro through a space of 6 feet, as admitted by Mr. Herbert, but which I think is greatly underrated, will be found to afford ample scope for the skill of the optician and mechanic. But, before the adoption of a floating tower can be recognised, some means must be contrived for adapting an *equally perfect* lighting apparatus to the oscillatory and rotary motions of the tower in which it is to be placed—a problem whose solution is, I fear, impossible in lights of the first order. But this difficult problem must undoubtedly be solved before a floating tower is adopted, for it cannot be admitted that any circumstances could justify the use, in such important stations

as the Eddystone, the Bell Rock, or the Skerryvore, or the Bishop Rock (now in progress of construction), of a less perfect means of illumination than that used in the lighthouses erected on the headlands and islands of our coast.

Another obvious objection may be stated, which happens to be very forcibly illustrated in the case of the Bell Rock. No one who is conversant with the circumstances of the case, will venture to affirm that that dangerous reef lying so directly in the track of shipping, whether bound for the Forth or Tay, or passing to and fro along the coast, could be effectually marked by means of anything short of a light erected upon it. Mr. Herbert has not, I suspect, fully considered the important question as to the site in which his proposed tower could, in the situation alluded to, be moored. It must be recollected that the "mooring ground" for a floating light, is analogous to the "foundation" for a light tower. It is in fact the primary inquiry, without a determination of which, based on *careful observation*, it is impossible to offer an opinion as to the practicability of maintaining the moorings, on the stability of which the safety of the structure must depend. The first question therefore, is,—taking into consideration the nature of the bottom and the depth of water around the Bell Rock—at what distance from the rock can a safe mooring be found? The experience obtained during the progress of the works is undoubtedly the best means we possess of approximately solving this question. The floating light used during the building of the Bell Rock was a vessel of 82 tons burden; and, after much consideration, and every care being bestowed on the subject, she was at first moored at the distance of one mile from the rock; but it soon became apparent that she could not ride in safety at that anchorage, and her moorings were ultimately removed to the distance of 2½ miles. It is further worthy of remark, that this vessel, although moored with all care (because on her stability the progress of the works mainly depended) *twice broke adrift* and *was once run foul of by a vessel* during the four years she was in use. To what greater distance it might be necessary to remove before a proper depth of water and sufficient holding ground for the safe anchorage of such a tower as is proposed could be obtained, is a matter to be settled only by *careful survey*,—but it is obvious that it could not be nearer than the site of the floating light; and it surely needs no argument to prove that a light exhibited at the distance of between two and three miles from a rock, can never be represented as fulfilling "as efficiently" the object of a light-tower erected on the rock itself.

It is probably unnecessary to suggest further difficulties, but other objections may be mentioned as being peculiar to the floating light, and from which the fixed tower is in a great measure, if not altogether, exempt. For example, the result of such a tower breaking adrift by stress of weather, or being driven from its moorings by a vessel striking it, would be the extinction of the light, and the almost certain destruction of the structure itself, and of its inhabitants; whereas with a fixed tower this cannot happen, and even should an ordinary light-vessel part from her moorings, sail can be set, and some chance is held out of working the vessel into a place of safety, which, indeed, has often been accom-

plished. Again, the floating tower cannot remain constantly at its moorings; it must necessarily be removed at intervals for the examination and repair of the bottom, and this in such a situation, for example, as Skerryvore, which is far removed from all mechanical resources, cannot be accomplished without great difficulty and expense. Its temporary removal further involves the necessity of its place being supplied by a duplicate tower and apparatus, for which I do not know that Mr. Herbert's estimates provide. Then the further question is raised, where can this duplicate tower be kept?—where can the permanent tower be placed, so that her bottom may be repaired?—and, above all, what steam-power must be at command, and what risk must be encountered, in towing these towers to and from their sites in such a situation as Skerryvore? But it is unnecessary to enter into greater length as regards these or other objections, as my object is not to point out defects in the proposed *floating* tower, but rather to show that such a structure, even if successfully constructed and safely moored, cannot in any sense be held to be a substitute for the Bell Rock, the Eddystone, or the Skerryvore lighthouses, which, once erected, remain for ever, are more efficient, and are subject to no such uncertainty as attaches to a floating structure.

On what, then, it is natural to inquire, does the recommendation of the proposed iron floating light depend? Not certainly on its greater efficiency, but exclusively on the smaller *estimated* cost of its construction. Nothing is said in the report of the Transactions of the Institution of Engineers on the very important subject of the cost of its future maintenance, which, from the number of men that would be required to take charge of so great a floating structure, the constant tear and wear connected with the moorings, and the expense attending its periodic removal for repair, would obviously be much greater than the cost of maintaining a fixed light-tower. The question of maintenance, however, is not adverted to, and in comparing the estimated *first cost* of the proposed floating light, with the actual cost of the existing lighthouses, Mr. Herbert has somewhat overrated the cost of Skerryvore, and has also, in all probability, overlooked the fact that the amount expended on that lighthouse includes a large expenditure connected with harbor accommodation, together with a signal tower and light-keepers' houses on the neighboring island of Tyree; and that a similar expenditure is included in the cost of the Bell Rock. Now, in any statement in which the expense of these lighthouse towers is to be fairly compared with that of a floating light, it is obvious that these additional expenses should either be deducted or be held as common to any light, whether floating or fixed, which could be established at these places.

Whether Mr. Herbert has adopted this mode of dealing with the estimates, and has included any sum for a duplicate light to be used in the event of the permanent one breaking adrift or being removed for repair, I have no means of knowing; but according to my view of the matter, it is of very little consequence whether he has done so or not, because if by adopting *a more perfect means of illumination exhibited from a more advantageous site, with the absolute certainty of the due exhibition of the light not being interrupted by any casualty, it be admitted that a single ves-*

sel may be saved from shipwreck, then the whole argument founded on the comparison of costs falls to the ground.

Are we, it may be asked, to spend millions of money on the construction of harbors of refuge at Plymouth, Kingstown, Holyhead, Portland, and Dover, for the benefit of our shipping, and to adopt an uncertain and imperfect mode of lighting such terrors to the mariner, as the Eddystone, the Bell Rock, the Skerryvore, or the Bishop, for the sole purpose of effecting a paltry saving of a few thousand pounds? I cannot believe that the importance of such works has been fully estimated by those who can entertain such a proposal.

Many are the vessels that have been lost, and the mariners that have met their graves, in consequence of these dangers. In one remarkable gale at the beginning of this century, seventy vessels were ashore at the same time on the coast of Scotland, the most of which got embayed in their endeavors to avoid the Bell Rock;—at Skerryvore, too, there are authentic records of no fewer than thirty-one vessels having been wrecked upon the rock. Whereas, now that permanent and powerful lights are erected upon these dangerous reefs, vessels steer for them with confidence as beacons of safety, and wrecks upon them are now happily altogether unknown. In these days of enterprise, when such sums are expended by government in harbors of refuge, and even by private companies in works for facilitating our internal communication—such, for example, as the High Level Bridge at Newcastle, or the Britannia bridge across the Menai Straits,—it is impossible to conceive that the country would be satisfied with anything short of the *most perfect* possible means of indicating to the mariner such dangers as these we have been considering, however high the cost of obtaining so important an end might be; nor can I conceive such a case to be a legitimate one for any compromise between *efficiency* and *economy*.

In conclusion, I should not wish to be understood as opposing any obstacle to the improvement of floating lights and buoys: so far from this being the case, a buoy on the construction proposed by Mr. Herbert, and ordered by the Commissioners of Northern Lighthouses at my suggestion, was moored by me in the Firth of Forth, and has now been in use for upwards of two years. I am bound, however, to say that that buoy, although not exposed to very heavy seas or strong currents, does "not retain its perpendicularity," and does not show better (some are of opinion not so well) as the buoy formerly in use at the same place, which cost 23*l*., whereas Mr. Herbert's buoy cost 102*l*. Still, however, I am not prepared to undervalue Mr. Herbert's investigations, nor to deny that for certain purposes and in certain situations they may be found exceedingly useful; and whenever I shall see an opportunity where they may be advantageously applied, I shall readily adopt them.

My only object in offering these remarks—which have been called for by the reference made to existing lighthouses—is to express my decided opinion, that whenever it can be proved that the erection of a fixed lighthouse on such important rocks as the Eddystone, the Bell Rock, or the Skerryvore, is by *any means practicable*, no question of economy can justify the adoption of what I must style the clumsy expedient of a tower

dependent for its stability on moorings, and containing a light *less efficient than the ordinary sealights on the coast*, and even this imperfect light *situated (it may be) some miles from the danger which it is intended to indicate*, and on which the light ought to be placed in order to be useful.

84 *George Street, Edinburgh, Dec.* 10, 1855.

---

*On the Draining of the Haarlem Lake.** By Prof. DOWNING.

The lake of Haarlem, situated in North Holland, contains 44,500 acres, which, previous to its drainage, was covered with a depth of thirteen feet of water, the surface of which was under the mean tide level of the sea; it is now completely dry and under cultivation.

To have an adequate idea of the difficulties encountered in bringing this work to a successful termination, it is necessary to consider the peculiar physical and artificial circumstances of the Netherlands. The greater portion of the surface is at or below the level of the sea, and only protected from being again covered with water by immense dykes, which guard it alike from the rivers and the sea. Along the greater portion of its western boundary, it is, however, in a great degree protected by the *dunes* or sand-hills which form the coast line. The rise of tide along the coasts of the Zuyder Zee is only two feet, and upon the west, in the German Ocean, it is six feet, the mean level being very nearly the same. The annual rain-fall, as deduced from observations continued for nearly one hundred years, is on the average 25·15 inches; the mean annual evaporation is 22·6 inches, distributed, however, very unequally in the winter and summer seasons, thus:

	Summer.	Winter.	Total.
Fall of rain,	10·5 in.	14·65 in.	25·15 in.
Evaporation,	15·9 "	6·7 "	22·6 "
	−5·4 in.	+7·95 in.	=2·55 in.

As to the artificial features of Holland, we find that from the very earliest times it has been divided into districts of greater or less extent, placed under the control of a governing body (*Waterschappen*), which we may call the Hydraulic Administration; the boundaries of these administrations (which are not conterminous with those of the provinces, or any fiscal or municipal districts) are formed by large and lofty dykes, in which are placed self-acting sluices for the discharge of the waters within the boundary dyke, and closing against the admission of any of the external waters. Lake Haarlem is situated in the administration of Rynland, which has discharging sluices into the German Ocean at Katwyck, into the Zuyder Zee at Sparndam and Halfwege, and into the river Yssell at Gouda.

Within every Hydraulic Administration are three divisions of surface, called the Natural Lands, the Basin, and the Polders. The basin is the total area of water surface within the boundary dyke; the natural lands

* Proceedings of the Royal Irish Academy, 1854-5.

are a little above the level of the basin, and discharge the rain-fall off their surface naturally; the polders are lands below the level of the basin, at various depths, from a few inches to twenty feet, and from which, consequently, the water must be raised mechanically, by wind-mills generally, and latterly by steam-power. The Rynland contains—

Basin, . . .	56,000 acres.
Natural lands, . .	76,000 "
Polders, . . .	173,000 "
	305,000 acres.

Lake Haarlem, which had been part of the basin, is now added to the polders, so that, instead of 56,000 and 173,000 acres, we now have 11,500 acres of basin, and 217,500 acres of polders, in this Administration. Regarding, then, the basin in its most important duty, that, namely, of a receptacle of the rain-fall when the self-acting sluices may happen to be closed against the external waters, we see how greatly its powers of storage are now reduced. To obviate this disadvantage it was necessary to put up engines of 200 and 100 horse-power at Sparndam and Halfwege, and widen the channel leading to the Katwyck sluice. Another work preliminary to the drainage was the navigable canal (*Ringvart*), adapted to vessels drawing 8 feet of water, which previously traversed the lake; this canal had a total length of 36 miles, and width of 146 feet, the inner bank being in fact the dyke surrounding the lake, and cutting off the waters which otherwise would flow in during and after the laying dry of the bed.

All preliminary works being thus completed, the raising of the waters up to the level of the sea was effected by three engines of 350 horse-power each, on the Cornish principle, constructed by Harvey & Co., at Hayle foundry, after designs by Messrs. Gibbs and Deane; the cylinders were 12 feet diameter and 10 feet stroke. From numerous and unforeseen causes of delay they were thirty-nine months in raising the water; and instead of 800,000,000 of tons of water, the computed contents of the lake, they actually raised 1100,000,000 tons. These engines will be required for all time to keep dry the land they may be said to have created, not, however, by that continuous working by which the first operation has been performed, but by throwing off extraordinary rain-falls before they have injuriously affected the land. Eight inches of rain-fall and infiltration per month is the maximum quantity that long continued observations lead them to expect, and this can be raised in about twenty-five working days by the 1150 horse-power of the three engines.

The original estimated cost of all the works of the drainage was £687,500; the actual expenditure, £827,200. The sale of the land has realized about £400,000, and the land tax, 7*s.* 4*d.* per acre, being capitalized, would yield a like sum; nor must we omit the saving of £5000 per annum, formerly expended in guarding the banks of the lake from destruction during storms, but which now of course ceases.

AMERICAN PATENTS.

List of American Patents which issued from February 19th, to March 11th, 1856, (inclusive,) with Exemplifications.

FEBRUARY 19.

93. For *Improvements in Machines for Sowing Seed Broad-cast;* Edward H. Berry, Hudson, New Hampshire.

Claim.—"The perforated sowing cylinder, and the secondary internal perforated distributing cylinder, connected with the hopper at its centre by the tubes, with its central portion or tube enlarged, so as to distribute the seed evenly to the whole length of the lower portion of the sowing cylinder, in order that the seed may be cast or sown evenly broad-cast over the soil."

94. For an *Improvement in Forks;* Sherburne C. Blodgett, Philadelphia, Pa.

Claim.—"The construction of forks, with a metallic web or sheets between a part of the prongs."

95. For an *Improved Fountain Pen;* Henry A. Brown and James Wiley, Brooklyn, New York.

Claim.—"Making the pen with a solid half-circular head, and arranging it to slide in the pen holder, (having a face-plate, as set forth,) so as to operate as a slide valve or cut-off to the flow of ink."

96. For an *Improvement in Machines for Sawing Marble;* Wallis Bull and George Bull, Tonawanda, Pa.

Claim.—"Securing the saws in the frame by means of the boxes, provided with rollers and rods, having on their inner ends swivel boxes, to which the ends of the saws are attached, whereby the saws may be properly strained in the saw frame, and at the same time allowed to move laterally therein."

97. For an *Improvement in Cooking Stoves;* Abner Burnham, Albany, New York.

Claim.—"The combination of an air chamber surrounding the fire chamber having inlets for the admission of air from without, with an air flue lying between the top of the fire chamber, with its flue and the top plate of the stove, together with an outlet from the same by a pipe or radiator placed within the smoke pipe or flues."

98. For an *Improvement in Rolling Metal;* G. H. Corliss and E. Harris, Providence, Rhode Island.

Claim.—"1st, The combination of the reciprocating roller carriage, with the guides and a table. 2d, Raising the roller for the purpose of placing the work between it and the table, by fitting the roller carriage to the oblique slots in the sliding boxes, providing latches to secure the carriage in the sliding boxes during the rolling operation, but to loosen them and allow them to run up the slots at the termination of the return movement of the roller. 3d, The arrangement of the crank shaft relatively to the rolling table and roller carriage."

99. For an *Improvement in Forging Thimbles;* G. H. Corliss and E. Harris, Providence, Rhode Island.

Claim.—"1st, The employment of forging thimbles, of an anvil and hammers. 2d, In combination with the arrangement of the shafts, of the eccentrics out of the stocks which carry the hammers or squeezers, we claim the inclined guides to receive the said stocks, after the withdrawal of the eccentrics, and the levers for the movement of the stocks up the said guides to withdraw the hammers or squeezers from the interior of the thimble to admit of its removal from the machine."

100. For an *Improvement in Vault Covers;* John B. Cornell, City of New York.

Claim.—"The flat faced panes of glass secured in positions that bring their exposed surfaces flush, (or a little above) the upper faces of the bars of the metallic frame, when said bars have grooves between said upper faces which form gutters around the panes of glass."

101. For an *Improved Grapple for Raising Stone;* Marcus M. Cass and L. R. Bigelow, Watkins, New York.

Claim.—"The combination of the levers, braces, and wedge, for the purpose of making a grapple for raising stone or other heavy bodies, when the power to raise such bodies is applied to the wedge, and through it to the levers to cause their jaws to tightly grasp and hold the body to be raised."

102. For an *Improvement in Sewing Guides;* Seth P. Chapin, City of New York.

Claim.—"The method of forming hems on the edge of flexible materials by means of folding guides made to turn the edge 180° or more. Also, the employment of a spring or analogous device; 1st, To hold and guide a piece of cloth by an edge or plait. 2d, To cause the cloth to follow the guides placed between it and the needle with certainty. 3d, To keep the cloth on a stretch while the stitch is being drawn."

103. For an *Improvement in Seeding Machines;* Stephen Gorsuch, Altoona, Pa.

Claim.—"Placing the screws in the conveying tube or spout, the front or back sides of the tube or spout being open."

104. For an *Improvement in Power Looms;* John Johnson, Troy, New York.

Claim.—"Inserting the wires at the same instant the shuttle is thrown, by which I save a pick by the employment therefor of a double shed. Also, the vibrating belt or its equivalent to which the wires are connected, arranged, and combined."

105. For a *Flexible Pen-holder;* Francis J. Klein, City of New York.

Claim—"A pen-holder constructed in two distinct and separate pieces or sections, so that the lower section shall be a lever having the metallic rivet as a fulcrum. Also, the peculiar formation of the chamber in section, and of the arm of the lever, by means of which formation and adaptedness each to the other, the holder is rendered more symmetrical, compact, and a movement of the aforesaid lever is permitted only in one direction, and for a limited distance, and a motion in any other direction is absolutely prevented."

106. For an *Improvement in the Mole of Draining Ploughs;* A. E. & C. Marquiss, Monticello, and Charles Emerson, Decatur, Illinois.

Claim.—"The peculiar shape of the mole, which enables its forward movement to form a subterranean perforation whose top and sides will be smoothly and densely compressed, and whose bottom will be left almost entirely uncompressed. Also, giving the tail of the mole such a shape and position that it will serve to close up the slit cut by the mole shank in forming the perforation, and also serve to lead the mole upwards to the surface of the ground as soon as the beam is allowed to turn on its axis."

107. For an *Improvement in Ploughs;* James B. Mell, Riceboro', Georgia.

Claim.—"The standard with braces in combination with braces and beam constructed in the manner set forth."

108. For a *Machine for Tenoning Window Blinds;* John H. Palmer, Elmyra, N. Y.

Claim.—"Operating the disks to which the cutters are attached by means of the cams arranged as shown."

109. For an *Improvement in Billiard Table Cushions;* Michael Phelan, City of New York.

Claim.—"A billiard table cushion composed of a block of india rubber, a layer of cork, and a strip of leather."

110. For an *Improved Mode of Applying Shafts to Axles;* Charles S. Pitman, Swampscot, Massachusetts.

Claim.—"The manner in which I have applied such to a shaft and axle, the same consisting in extending the india rubber bolt protector each way beyond the holding strap, in combination with extending it entirely around the bolt, whereby under any upward or downward movement of the shaft, not only the bolt but the connexion fork will be protected from wear and liability to make a noise, while under sudden starting or stopping off the draft animal connected to the shaft, and the strain on the bolt and fork will be eased by the spring or elasticity of the bolt protector."

111. For an *Improvement in Temples for Looms;* Rensselaer Reynolds, Stockport, New York.

Claim.—"The arrangement and gear of the shank of the opening and closing jaw with the stop or roller, in combination with the closing and receding spring, for the operation together."

112. For an *Improvement in the Construction of Pessaries;* F. Roesler, City of New York.

Claim—"An instrument composed of a ring and two supporting pieces hinged thereto by spring stop-hinges, either with or without a front or back supporting piece. Also, fitting the supporting pieces to their hinge with a pin and socket, or the equivalent thereof, to allow of one or both of the supporting pieces being set obliquely to the ring or extended lengthwise."

113. For an *Improvement in Hubs for Carriages;* Joseph Smith, Sunbury, Delaware County, Ohio.

Claim.—"The combination with the axle of vehicles of a segmental box, slotted cylinder, and friction rollers."

114. For a *Machine for Printing from Engraved Plates;* James F. Starrett, City of New York.

Claim.—"1st, One or more traveling platforms attached to revolving arms and carrying engraved plates from inking to wiping, and then to printing apparatus, in succession, or to any two such—such apparatus being so arranged that the last and first of the series are next in succession, and the arms revolve in the same direction continuously. 2d, Causing engraved plates, which are carried around in the circumference of a circle, to be submitted to a printing cylinder in a line parallel to its own axis, and not in radial lines of the circle in which the plates are carried, and then permitting them to pass in contact with said cylinder in lines perpendicular thereto, and not in the arc of a circle. 3d, Imparting to a plate or plates thus handed, a zig-zag or devious progressive motion, while they are passing in contact with certain cloths or rollers. 4th, The flexible connexion between the plates or their beds, and the handing or carrying arms, as also, grooved tracks, or their equivalents, acting upon beds so attached, and also these two in combination. 5th, Such flexible connexion in combination with a stop, whereby an engraved plate carried upon a revolving arm is properly presented to the action of the impression cylinder. 6th, Wet wiping an engraved plate by means of a traveling cloth acting in combination with a plate having a zig-zag progressive motion. 7th, An automatic oscillating receiving table in connexion with the printing apparatus, wherein are printed in succession, sheets having different matter printed thereon, so that similar sheets may be laid in the same pile. 8th, Vibrating chaps or fingers in combination with the tapes for completing the delivery of a printed sheet and depositing it upon a table."

115. For *Improvements in Machines for Sawing Marble in Obelisk Form;* P. Schrag and Wilderich J. Von Kammerhueber, Washington City, District of Columbia.

Claim.—"1st, The use of belts or their equivalents, adjustable in their length, in combination with the saw frames, in which the saws are strained independently of said belts, whose adjustability is solely for the purpose of permitting change in the distance or in the angle of the saws. 2d, The saw supporters adjustable both horizontally and vertically, whereby we are enabled when cutting parallel or inclined grooves, to place the saws in the same plane, that they may commence and end their work simultaneously; and also, when it is desired to cut crosswise or to a point, to place the saws in different planes the one above the other. 3d, The adjustability of the roller upon the shaft of the straining apparatus, which permits the retention of the belts in a horizontal plane, whether the saws and their frames are placed in the same or in different horizontal planes."

116. For an *Improvement in Machines for Preparing Vegetables for Preservation;* Masa B. Southwick, St. Hilaire, Canada East; dated February 19th, 1856; patented in England September 15th, 1853.

Claim.—"The improved mode of separating the skins or peels of potatoes and other vegetables from the pulp and skins together, against the denticulated or serrated edge or edges of pieces of metal or other material, whether such pieces be aqueline-shaped or otherwise, provided the skins are caught by the teeth and are thereby separated and taken from the pulp, whether the teeth be shaped like saw teeth or otherwise, or whether

the working table be of circular form and revolving, or be made of any other shape, and caused to vibrate and move from side to side to produce the effect of the circular trough or table."

117. For an *Improvement in Furnaces for Heating Slugs for the use of Hatters, Tailors and others;* Russel Wildeman, Charlestown, Massachusetts.

Claim.—"The plate in combination with the fire box and lifting arrangement."

118. For an *Improved Stave Machine;* George W. Livermore, Assignor to Livermore Manufacturing Company, Cambridgeport, Massachusetts.

Claim.—"The machine for jointing, crozing and chamfering staves, consisting essentially of the clamp for holding the stave, the jointers, and the crozing, chamfering cutters."

119. For *Photographic Pictures on Japanned Surfaces;* Hamilton L. Smith, Gambier, Assignor to William and Peter Neff, Jr., Cincinnati, Ohio.

Claim.—"The obtaining positive impressions upon a japanned surface, previously prepared upon an iron or other metallic or mineral sheet or plate, by means of collodion and a solution of a salt of silver and a camera."

FEBRUARY 26.

120. For an *Improved Machine for Depositing Coal in Cellars;* William Bell, Boston, Massachusetts.

Claim.—"The bed-plate, conductor, and slide, with the tube attachments, in connexion with a hole in the cart, or other vehicle."

121. For an *Improved Pitman;* Andrew Blaikie and Walter Clark, St. Clair, Mich.

Claim.—"The exclusive application of the hollow rod or tube, and the combination therewith of the wood, bushes, and straps, gibs, keys and bolts."

122. For an *Improved Machine for Edging Wall Paper;* H. J. Brunner, Nazareth, Pennsylvania.

Claim.—"The bearing parts, supporting arms, movable blocks, sliding carriage, and adjusting device. Also, the sliding clamps. Also, the combined arrangement of the rolling and unrolling devices, so that they may be quickly shifted from one side of the machine to the other."

123. For an *Improvement in Wagons;* Benjamin B. Bundy, Walton, New York.

Claim.—"The mode of combining springs or axles of wagons."

124. For an *Improved Mill Saw;* Nathan T. Coffin, Knightstown, Indiana.

Claim.—"The arrangement of the common shaped mill-saw teeth on the blade, in sets of three teeth each, with a wide deep space under the lower tooth of each set of teeth. Also, the increasing of the space of the teeth from the centre of the saw each way to the ends. Also, the regular combination of the square edged to the diamond or bevel-pointed teeth, the former standing straight with the blade."

125. For a *Combined Knife and Pencil Case;* Richard Cross, Attleboro', Mass.

Claim.—"My improved mode of constructing such a handle, viz: of two separate tubes, so formed and applied, that when one is extended through the other, it shall not only serve to support it on two of its opposite sides, so as to prevent them from being crushed inwards, but form with the remainder of the enclosing tube, and between it and the latter, one or more chambers, for the reception of instruments. Also, arranging the spring of the knife blade in a slot, made through the shank of the blade."

126. For a *Dove-Tailing Machine;* Ari and Asahel Davis, Lowell, Mass.

Claim.—"The arrangement and operation of the cutters, one movable and adjustable with the bar which carries it, and the other stationary, so as to bevel and form the groove in one end of the wood, and bevel and form the tongue to fit the groove on the opposite end of the wood, at one single operation, so as to complete the dove-tailing of each piece of any desired length without changing the cutters. Also, the carriage, or its mechanical equivalent, and its movable and adjustable slide, which carries the board being dove-tailed, and which can be moved and adjusted, in conjunction with the bar or way, and cutters thereon, so as to give any desired length to the board."

127. For an *Improvement in Machinery for Making Shirt Collars;* Othniel W. Edson, Troy, New York.

Claim.—"The jaws, tongues, and blades, to simultaneously fold inward two contiguous edges of double cloth. Also, giving a forward longitudinal motion to the blades immediately after the edges of the cloth have been turned inward, thereby to complete the formation of the corners of articles folded."

128. For an *Improvement in Churns;* John W. Fiester, Winchester, Ohio.

Claim.—"The cams and eccentric circle, in combination with the agitators, for the purpose of breaking or cutting the current of cream in its passage through them, and for producing friction, by the lateral motion of the two sides of the agitator."

129. For an *Improved Box for Carriage Hubs;* A. C. Garratt, Roxbury, Mass.

Claim.—"The combination and arrangement of this peculiar lubricator, with the recess groove or oil chamber of the box, so as to form an improved combination wheel box for carriage axles."

130. For an *Improved Coupling for the Joints of Felloes;* S. A. Garrison and D. C. Morey, Chelsea, Massachusetts.

Claim.—"The stay bolt, composed of head, stay, and bolt, in combination with the embracing cap piece, tightened, for securing the joints of felloes from lateral movement, in addition to security against radial action."

131. For an *Improved Air-cock for Steam Heating Apparatus;* Stephen J. Gold, New Haven, Connecticut.

Claim.—"The automatic regulation of the air-cock, by a secondary action of a fluid which vaporizes at a low temperature."

132. For an *Improvement in Girders for Bridges;* Peter C. Guiou, Cincinnati, O.

Claim.—"The application of segmental timbers on the top of the iron arch. Also, the peculiar combination of parts, constituting the arch, to wit: the two angle irons, the spurs or double screw-backs, and the timbers."

133. For an *Improvement in Arched Trussed Bridges;* Horace L. Harvey, Quincy, Illinois.

Claim.—"The use of compression braces, in combination with the tension braces, to support alternate bearing points. 2d, The clamps, with or without slots in them, or slots in the arch, with or without friction rollers transversing the wedge blocks, in combination with the truss, for the purpose of allowing the truss to rise and fall, in proportion to the change in the chamber of the arch."

134. For an *Improvement in Projectiles;* Charles T. James, Providence, R. I.

Claim.—"1st, The combination of a band of fibrous packing around a cannon ball, with a means of distending it into the screws or rifles of the cannon, (without enlarging the shot itself, as is done, when it is wholly or partially formed of flexible metal,) by the pressure of the explosive gas. 2d, The combination of a mandrel passing through the shot, for the purpose of driving out the pins, with a nut for drawing it in. 3d, The combination of a mandrel entering the shot with a ratchet, or equivalent catch, for holding it in its place. 4th, The combination of any pliable packing ring surrounding the shot with the openings communicating between its inner surface and the chamber where the explosive gas is generated, for the purpose of communicating the power to distend such packing."

135. For an *Improved Machine for Separating Gold and other Precious Metals from Foreign Substances;* Edward N. Kent, City of New York.

Claim.—"The employment of what I term a grain separator, for separating the grains of metal from the earthy substances or crushed gangue, preparatory to, and in combination with the crusher, or equivalent therefor, when the separator is employed as a hopper to the crusher, and combined therewith by a feeding tube, or equivalent therefor, for conducting the substances to be crushed, below the surface of the column of water in the crusher. Also, an improved Chilian mill, consisting of a deep water vessel, holding a high column of water, in which the double acting vertical wheels combined therewith, are wholly, or nearly submerged."

136. For an *Improvement in Lamps;* W. M. Kimball, Rochester, New York.

Claim.—"The recess."

137. For an *Improvement in Domestic Steam Generators;* James T. King, City of New York.

Claim.—"The combination of a water tank, steam chamber, and steam generator, connected together, so that the height of the water in the water tank above the orifice of the pipe leading to the steam chamber, shall always regulate the pressure of the steam, while there will be a free escape of steam as soon as the water in the water tank falls below said orifice."

138. For an *Improvement in Percussion Locks for Fire Arms;* J. H. B. Latrobe, Howard County, Maryland.

Claim.—"1st, The hammer, chambered to receive the primer, in combination with a pusher attached to the lock plate, and protruding the primer as the hammer moves. 2d, The movable cutter, in combination with the projection on the piece, to cut off the cap to be exploded, while at the same time it closes the chamber and protects the rest of the primer from the fire of the explosion. 3d, The claw on the end o the detent, to keep the primer always in place for protrusion. 4th, The movable catch for throwing the pusher out of play. 5th, The ferrule round the boss, in combination with the chambered hammer. 6th, The twisting of the primer between the boss and pusher, to permit of its being bent to suit the form of the hammer. 7th, The arrangement of the parts above described, so as to protrude the primer, while the hammer is filling, instead of while the piece is being cocked."

139. For a *Process of Painting or Varnishing Woven Wire;* William Lincoln, Oakham, Massachusetts.

Claim.—"Exposing the wire-work cover or article, after having been dipped in the varnish, to a powerful blast or current of air, so brought to bear upon it as to pass through and clear its meshes of the liquid varnish, and pile it more on one side of each side of the wires, than on the opposite side thereof."

140. For an *Improvement in Horse Rakes;* Nathan Martz, Briar Creek Township, Pa.

Claim.—"The combination of the coiled spring, axle, rock shaft, and rake teeth."

141. For an *Improvement in Binding Guides;* James S. M'Curdy, City of N. York.

Claim.—"The centre piece, in combination with the plates, for the purpose of adjusting the binder, for the use of binding of different widths, and of applying the same with unequal lap to the material bound."

142. For an *Improved Mode of Constructing Walls and Floors of Cellars;* A. R. Moen, City of New York.

Claim.—"The mode of forming walls and floors, by combining into one mass the cement and asphaltum, by means of the stone or other suitable material, by which the asphaltum is caused perfectly to adhere to the bricks or stone of the work, and admit the hydraulic cement; also, to adhere to the same stone or brick."

143. For an *Improvement in Sewing Machines;* T. J. W. Robertson, City of N. Y.

Claim.—"The looper."

144. For an *Improved Apparatus for Heating by Gas;* W. F. Shaw, Boston, Mass.

Claim.—"The combination and arrangement of air and gas burners, or distributors, chambers, and their flues and air supply conductors. Also, in combination with the gas burner, the open top and closed bottom wire gauze tube."

145. For *Improved Door Spring;* D. G. Smith, Carbondale, Pennsylvania.

Claim.—"The use of the lever, in connexion with the barrel and spring."

146. For a *Boring Machine;* James Temple, Birmingham, Pennsylvania.

Claim.—"The combination of the horizontal and vertical slides."

147. For an *Improvement in Velocimeters for Vessels;* Ira F. Thompson, Westerly, Rhode Island.

Claim.—"The gate or slide actuated by the vertical weighted lever or pendulum, in combination with the hinged drag."

148. For an *Improvement in Instruments for Measuring the Lengths of Braces in Carpentry;* Herman Whipple, South Shaftsbury, Vermont.

Claim.—"The button, to receive and clamp the square on the centre line of motion of said button. Also, the traveler, with one side on the line of the slot and centre of the button."

149. For an *Improvement in Machinery for Hardening Hats;* R. Wildman, Charlestown, Massachusetts.

Claim.—"The inflated elastic rubbers."

150. For an *Improved Method of Excluding Dust from Railroad Cars;* Joseph Wood, Jersey City, New Jersey.

Claim.—"The employment or use of the slotted frame attached to the sides of the bottom or platform of the car."

151. For an *Improvement in Bending Sheet Metal;* J. Wright, Harmar, Ohio.

Claim.—"The combination and arrangement of the setting down, bending, and finishing rollers or wheels, with the disk, for operation together, and in relation thereto and each other, the one wheel having a projecting ledge or bead, for the purpose of gauging the double seam, 'and clipping or holding it from opening' whilst being bent."

152. For an *Improvement in Cultivating Ploughs;* William C. Wyche, Brookville, North Carolina.

Claim.—"A series of knives or cutting blades on the standard, in the place of, and for dividing, cutting, and turning the furrow slice horizontally or nearly so, and depositing the pulverized soil mostly in the furrow, and turning the sod or turf upon the surface."

153. For an *Improvement in Coffee Pots;* Jacob M. Webb, Sommerville, Tenn.

Claim.—"The tubes and the fall."

154. For an *Improved Wheelwright Machine;* Chauncey H. Guard, Assignor to self and J. A. Scroggs, Brownsville, New York.

Claim.—"The combination of the boring and mortising shafts with the levers, through the medium of the toothed saddles, the toothed segments, and the oscillating shafts."

155. For an *Improved Arrangement of Means for Operating the Valves of Steam Engines;* John Scheitlin, Assignor to self and Oliver Dailey, Washington, D. C.

Claim.—"The four teeth cylinder, keyed on the main driving or crank shaft, the Maltese cross with the shaft and the small crank keyed thereto, said cross by means of the feather, being susceptible of a free and steady to and fro motion along, whilst driving its shaft, not being so moved by the rock and pinion, a screw, and by which, also, it can be retained on its shaft in any desirable position in relation to the cylinder, whereby a single steam valve of a steam engine can be worked, either as a feed valve, or as a feed and as a cut-off valve alternately, and the steam cut off at any required point of the stroke whilst the engine is in operation."

156. For an *Improved Sawing Machine;* William J. Wood, Assignor to self and John S. Gallaher, Jr., Washington, D. C.

Claim.—"Attaching the saws to the opposite ends of two parallel rocking beams, by means of swivel bearings, and in combination with the mode of straining. Also, in combination with the table and upright or column, the reversible graduated scale gauge."

Additional Improvements.

1. For an *Improvement in Hydraulic Heaters;* Lewis W. Leeds, and R. M. Smith, Philadelphia, Pa.; original patent dated May 16, 1854; additional Feb. 5, 1856.

Claim.—"The use of the radial ribs, in combination with tubes, irrespective of form of said tubes."

2. For an *Improvement in the Manufacture of Ornamental Felt Cloth;* O. B. Tomlinson, Athens, Pa.; original patent dated June 5, 1855; additional Feb. 5, 1856.

Claim.—"The manufacturing of ornamental felt fabrics, by placing loose woven or knit felting or shrinking fabrics of any color or design upon the surface of the sheet of batting, composed of any felting or shrinking substance, and shrinking the same orna-

menting fabric or fabrics into the body of the felt, to form an ornamental felt fabric of the character and quality described."

3. For an *Improvement in Candle-sticks;* Abner Whitely, Springfield, Ohio; original patent dated January 8, 1856; additional Feb. 5, 1856.

Claim.—"1st, Securing the lip to the stem, and within the slide, as described, whereby I am enabled to use a solid lip and avoid all leakage. 2d, The open slide as described, for avoiding damage."

4. For an *Improvement in Daguerreotype Cases;* John F. Mascher, Philadelphia, Pa.; original patent dated March 8, 1853; additional Feb. 19, 1856.

Claim.—"The combination and arrangement of a series of levers of any suitable material, containing photographic or other pictorial representations, (interspersed or not with blank or printed leaves) with supplementary lid or adjustable flap, containing a lens or lenses as described, the same being united or bound together so as to form a book."

5. For an *Improvement in Grinding Mills;* Amory Felton, Troy, N. Y.; original patent dated Jan. 2, 1855; re-issue Jan. 29, 1856; additional Feb. 26, 1856.

Claim.—"Combination with the cylinder, concave, and spiral ribs, the cracking or crushing apparatus preceding the grinding surfaces, for the purpose of adapting the mill to the grinding of corn, and the cobs, or other similar material."

Re-Issues for February, 1856.

1. For an *Improved Tongueing and Grooving Machine;* Charles W. Brown, Boston, Massachusetts; patented August 14, 1844; re-issued February 5, 1856.

Claim.—"1st, Giving a lateral movement to either of the edge cutters, by any suitable arrangement of mechanical devices, while the board is being fed through the machine so as to adapt the edge cutter to any taper of the board. 2d, Arranging the box or bearing of the shaft of either of the edge cutters, so as to slide laterally on a rail, and connecting said box or bearing to a sliding guide bar, which bar is governed or regulated in its movements by the edge of the board, and kept up against said edge by means of a weight operating on it (so as to press it laterally), through the medium of a rack and pinion. 3d, The combination of the sliding bolts with the turning rod, (having right angular arms,) and pawl and ratchet wheel on the end of the shaft which the weight turns or revolves, for the purpose of permitting or checking the operation of said weight upon the sliding guide bar."

2. For an *Improvement in Polishing Stone, Metals, &c.;* A. Broughton, Malone, New York; patented November 7, 1854; re-issued February 12, 1856.

Claim.—"A process by which the friction of the surface of the rotating polishing wheel upon the surfaces of the articles operated upon, will impart rotary movements to said articles."

3. For an *Improvement in Spike Machines;* Ammi M. George, Nashua, N. H.; patented December 18, 1855; re-issued February 12, 1856.

Claim.—"The friction roller and lever, to which the cutter is attached, when said roller and lever are placed upon adjustable centres, or pivots, or rods, in combination with pointing dies inserted in the jaws."

4. For an *Improvement in Machines for Sewing and Stitching Straight Seams;* Isaac M. Singer and Edward Clark, Assignees of J. J. Greenough, City of New York; patented February 25, 1842; re-issued February 12, 1856.

Claim.—"1st, The feeding of the article to be stitched automatically forward to the needles so as to determine thereby the length of the stitch by means of the apparatus. 2d, The employment of a weight, or its equivalent, to draw out the thread. 3d, The combination of pincers to draw the needles and thread through the article being sewed. 4th, For the purpose of working with two needles at the same time. I claim giving to the pincers a simultaneous lateral movement, to change the needle from one pair of pincers to the other. 5th, The stop motion consisting of an arrangement of apparatus described, for stopping the machine when the thread breaks or becomes too short."

5. For an *Improved Ticket Register for Railroad Cars, &c.;* William Apperly, City of New York; patented May 1, 1855; re-issued February 19, 1856.

Claim.—"Providing a suitable box for holding the tickets, and employing and ar-

ranging a distributing lipped slide upon the bottom of said box, or underneath the tickets, in combination with the employment and arrangement on top of the tickets of a spring or weighted follower. Also, providing the extension or small box inclined way."

6. For an *Improvement in Harvesting Machines;* John H. Manny, Rockford, Illinois, Assignor to P. H. Watson, Washington, D. C.; patented October 17, 1854; antedated June 15, 1854; re-issued February 19, 1856.

Claim.—"A draft bar or tongue, constructed with an arm extending backward over the main frame, and connecting it with a suitable device for supporting it at various heights, whereby the cutter can be conveniently adjusted to different heights, by an attendant on the main frame."

7. For an *Improvement in Sewing Machines;* W. H. Johnson, Greenville, Mass.; patented March 7, 1854; re-issued Feb. 26, 1856.

Claim.—"1st, Making of a seam with a single thread, by the combination of a single needle, forked hook, and expanding lever. 2d, The forming or making of a seam from a single thread, by the running of the loop of the thread through the material to be sewn, the running of a second loop through the material, and putting the first loop through the second, the running of a third loop through the material, and through the first named loop, the carrying of a fourth loop through the material, and putting the third through it, and so on, putting the first loop through the second and around the third, the third loop through the fourth and around the fifth, and so on, forming the belaying double loop stitch. 3d, The feeding of the material to be sewn by means of a vibrating piercing instrument, whether said instrument be the needle itself, or an independent instrument in the immediate vicinity thereof."

8. For an *Improvement in Spark and Gas Consumers;* David Matthew, Philadelphia, Pa.; patented Feb. 20, 1849; re-issued Oct. 4, 1853; re-issue Feb. 26, 1856.

Claim.—"The combination of the receiving case, shield-plate, or head and filterer, with and over the top of the sectional chimney, with enlarged base and smaller section in the smoke box, to convey off and arrest the sparks without pernicious effect. Also, increasing the base of the chimney beyond the diameter of the upper end of the section, extending vertically to near the lower horizontal flues and bottom of the smoke box, to aid in the generation of steam. Also, the trumpet-mouthed tube over the chimney, said tube being divided into two or more parts, to collect sparks and direct them inwardly by aid of the opening between said parts. Also, the manner in which I connect the case at the top of the chimney with the furnace or fire box, by means of the tubes or pipes, the cases, and the openings thence into the fire box or furnace, to carry the sparks and gas to the furnace to be consumed."

Designs for February, 1856.

1. For *Gates;* H. E. Wesche, Assignor to Robert Wood, Philadelphia, Penn.; dated February 5, 1856.

Claim.—"A gate for cemetery enclosures as represented on the drawing."

2. For *Printing Type;* Lawrence Johnson, Philadelphia, Pa.; dated Feb. 12, 1856.

Claim.—"The forming on the face of the printing type such figures that the letters printed therefrom shall represent in the upper portion of each letter a colored ground, with white stars, and in the lower portion, alternate white and colored stripes."

3. For *Moulded Bricks;* James M. Thompson, Philadelphia, Pa.; dated Feb. 12, 1856.

Claim.—"The shape of the brick and the ornaments that are on the brick."

4. For *Gates;* H. E. Wesche, Assignor to Robert Wood, Philadelphia, Penn.; dated February 12, 1856.

Claim.—"The design for a gate, as represented."

5. For *Bottle Castors and Egg Cup Stands;* R. Gleason, Jr., Assignor to R. Gleason, & Sons, Dorchester, Mass.; patented Feb. 12, 1856.

Claim.—"The ornaments upon the sides of the case, the scrolls on the upper and lower edges of the sockets, the ornaments upon the outer sides of the sockets, the beaded rims and scrolls on the plates, and the figure and levers which form the main portion of the handle."

6. For *Cooking Stoves;* S. Pierce, Troy, and James J. Dulley, Yonkers. Assignors to Cox, Warren, Morrison & Co., Troy, N. Y.; patented Feb. 12, 1856.

7. For *Stove Plates;* Sanford Burnam, Assignor to Cox, Warren, Morrison & Co., Troy, N. Y.; patented Feb. 12, 1856.

8. For *Cooking Stoves;* Samuel Pierce and S. Burnam, Assignors to Cox, Warren, Morrison & Co., Troy, New York; patented Feb. 12, 1856.

9. For *Parlor Stoves;* William T. Coggeshall, Fall River, Mass.; patented February 19, 1856.

Claims to the above four patents, are for the ornamental designs as represented in the drawings."

MARCH 4, 1856.

1. For an *Improved Apparatus for Cooking with Quicklime;* W. W. Albro, Binghampton, New York.

Claim.—"The apparatus or device formed of the vessels."

2. For an *Improved Machine for Sweeping Streets;* Timothy Alden, Troy, New York.

Claim.—"1st, The arrangement and use of the sliding boxes, springs, and levers, in combination with the broom handles and crank-shaft, for the purpose of making the brooms self-adjustable under all circumstances, to overcome the inequalities of the pavements to be swept. 2d, The use of the guard board arranged longitudinally of the machine, for the purpose of collecting the dirt in winrows, in combination with the brooms for sweeping the dirt against the said guard board. 3d, The use of the collecting and elevating wheel, in combination with the guard board and revolving brush. 4th, The use and arrangement of the shield board, for the purpose of holding the dirt within the buckets of the collecting and elevating wheel, till ready to be discharged therefrom; hopper boards and endless carrying board, in combination with the connecting wheel."

3. For an *Improvement in Machines for Sawing Marble in Taper Form;* Christian Amazeen, New Castle, New Hampshire.

Claim—"The jointed guide bars arranged so that two pairs of saw frames may be driven from one shaft, and one pair of saw frames be set if desired at different angles or degrees of obliquity from the other pair."

4. For an *Improvement in Manufacturing Hats;* James W. Beebee, Brooklyn, N. Y.

Claim.—"Making hats with a stiffened body, combined with a felt covering, reduced to the required form by felting, and put over and attached thereto with hatters' varnish or other equivalent adhesive substance."

5. For an *Improvement in Corn Harvesters;* William M. Bonwill, Camden, Delaware.

Claim.—"The two saws placed at the front part and at each side of the platform, in combination with the horizontal plates or beds and discharge rods."

6. For an *Improved Skein for Axle Arms;* John M. Burke, Danville, New York.

Claim.—"Constructing the skein of a metal plate which is bent in conical or taper form, with a space or opening in its upper part; the skein being secured to the arm by means of the bolts."

7. For an *Improvement in Ploughs;* James J. Cadenhead, Macon County, Alabama.

Claim.—"The adjustability of the brace in combination with that of the bar and that of the beam, for the purpose of regulating the pitch of the beam, and the height of the beam and handles, together or separately."

8. For an *Improved Shingle Machine;* Ransom Clifford, Lowell, Massachusetts.

Claim.—"1st, The combination of the driving bar attached to and moved by an endless chain, and the lever or levers, for the purpose of communicating motion to the shaving knives. 2d, The construction of the driving bar with the upright arms carried by the endless chains and chain gears, and its combination with the cross-bar and knives, in such a manner as that the driving bar shall be turned on its axis and be made to run clear of the knives just before it reaches them."

9. For an *Improved Arrangement of Steam Tubing for Regulating the Heating of Buildings;* Robert Cornelius, Philadelphia, Pennsylvania.

Claim.—"The arrangement of one section of the steam tubing within another section, whereby the steam tube itself is made to serve as a regulator and controller of the heat of the building."

10. For an *Improved Hinge for Shutters;* Isaac Davis, Groton, New York.

Claim.—"The use of the conical screw operating in combination with the wheel, held in position by and turning on the pin."

11. For an *Improvement in Harvester Rakes;* Owen Dorsey, Howard County, Md.

Claim.—"The combination with the rake arms, to which the rakes are firmly attached, of the vertical revolving shaft and cam way or guide, from which the rake arms receive an undulating motion in a vertical plane revolving about said shaft."

12. For *Self-acting Farm Gates;* Elon Dunbar, Philadelphia, Pennsylvania.

Claim.—"1st, The combination of the vibrating beams and railway with the lower bent and weighted lever upon which the flaps rest, and vibrating levers and rods for connecting them together, and the gate suspended on the railway. 2d, Constructing the gate in two parts, and suspending the lower part by the weighted lever, so as to enable the flap to draw said lower part downward during the raising of the upper main parts, to prevent a space for the passage of small animals being formed between the flaps and bottom of the gate. 3d, The combination of the series of parts, consisting of levers, rods, shafts, and radial arms, for operating the spring bolt, with the suspended gate."

13. For an *Improved Lubricator;* William E. Everett, City of New York.

Claim.—"1st, A stationary oil cup or reservoir in combination with a flexible tube, one of whose ends communicate with the cup, and the other with the surfaces to be lubricated. 2d, Giving motion to the spoons of a mechanical oil cup when it is used in combination with a flexible tube by means of a vibratory lever or its equivalent, which derives its motion from the tube itself."

14. For an *Improvement in Boot Crimps;* George Fetter, Philadelphia, Pennsylvania.

Claim.—"1st, The crimping of the upper leathers of boots, by confining and submitting them to the action of the leg and foot—the said leg and foot being jointed together at the instep. 2d, The radial adjustable guide, with its traversing pincers, in combination with the leg and foot."

15. For an *Improvement in Sheep Shears;* Luther B. Fisher, Coldwater, Michigan.

Claim.—"The so constructing of the shears as that the mere clasping of the hand or operating of the fingers in which the shears are held and controlled, shall produce a multiplied motion of the cutters."

16. For an *Improvement in Portable Houses;* Daniel Fitzgerald, City of New York.

Claim.—"1st, Constructing a house by inserting the weather-boarding ends into a channel at the corner-posts. 2d, The drawing together of the parts of the posts to secure the weather-boarding, it being held up against by nails or screws. 3d, The inserting the ends or tenons of the girders into the channel in such a manner that the weight of the chamber floor, roof, &c., may bear on the weather-boarding, and press the joints together, as it may shrink, or allow it to rise when it swells. 4th, The setting the girder in the same slot with the weather-boarding. 5th, Setting the floor plank ends in a channel in the girders or between the two halves of the girders, so that no nails are required, and so that the upper part of the girder will be the base of the room. 6th, The channeling the sides of the door and window frames, so that the weather-boarding can be inserted or taken out without the use of fastenings."

17. For an *Improvement in Supplementary Grating for Stoves, Furnaces, &c.;* B. F. Fœring, Philadelphia, Pa.

Claim.—"Cleaning or removing foreign substances, such as slate, cinders, clinkers, &c., from stoves, furnaces, or other heating devices in which anthracite coal is burned, by means of the supplementary grating applied to the stove or furnace, or inserted within it."

18. For an *Improvement in Riffle Boxes;* F. R. Ford, Ophir, California.

Claim.—"The arrangement of the riffles in respect to the surface of the quicksilver."

19. For an *Improvement in Power Looms;* James Greenhalgh, Sr., Waterford, Mass.

Claim.—"1st, The combination with the method of balancing the bars, the method of giving motion to the shaft to operate the boxes by means of two notched bars, which are geared with opposite sides of the pinion on the said shaft, and are suspended from levers which are operated upon by a pattern cylinder, in such a manner as to raise either of the said bars, as may be necessary to bring its teeth into engagement with a dog suitably arranged and operated, to give the requisite motion to the bar. 2d, The method of giving the shuttle boxes a single or double movement as may be required by the pattern, by employing two hooks by having unequal movements—arranging the said hooks or their equivalents with their points at different elevations, and employing long and short studs in the pattern cylinder to raise the rack bars which give motion to the boxes to a position to be caught only by the hook having the longer movement. 3d, Controlling the order of the succession of the movements of the two pickers to make them act in regular alternate succession, or otherwise, as may be desirable, by means of a pattern cylinder acting upon the mechanism—by which movement is transmitted from the driving shaft to the pickers, in such a manner as to throw or retain either picker in gear with the said shaft and the other one out of gear. 4th, The combination of the levers through which the cams on the driving shaft operate the pickers, with the sliding shaft, the lever and the V shaped stud, the said lever being moved from side to side by the pattern cylinder, and the said V shaped stud receiving a suitable motion to operate on the said lever."

20. For an *Improved Guard for Coal Holes;* George C. Jenks, Boston, Mass.

Claim.—"A coal vault mouth guard made expansive and provided with means whereby it shall or may be expanded, while being elevated to a horizontal position above the opening of the vault—the said guard by such means being caused when it is raised into a horizontal position, to extend beyond the sides of the opening so as to lessen the danger of accident to pedestrians."

21. For an *Improvement in the Apparatus for Heating Buildings, by the Combination of, and Burning of Gas, Air, and Steam;* Charles H. Johnson, Boston, Mass.

Claim.—"The combination and arrangement of an air divider, (a closed box having a perforated diaphragm extending across it and receiving air from a pipe,) with one or more gas receiving chambers, and the air and gas mixers of the burner diaphragm of the same."

22. For an *Improvement in Weighing Scales;* James Kelly, Sag Harbor, N. Y.

Claim.—"The arrangement of the two screws, at opposite ends with, and forming part of, the double beam, in combination with the nuts and weights, all constructed and operating together for the separate and simultaneous adjustment of the tare and gross weights from fixed points or distances at opposite ends of the beam."

23. For an *Improvement in Stoves and Furnaces for Railroad Cars and other purposes;* Dennis G. Littlefield, Albany, New York.

Claim.—"A fire pot or furnace provided with a series of enlargements or projections on its side or sides, commencing at, and extending upwards from the grate to contain the fuel while it is being burned or during its consumption, open or provided with openings at the top for the escape of the gaseous products of combustion. Also, a grate made around a solid centre or disk. A supplying cylinder in combination with the fire pot or furnace and grate, or either of them."

24. For *Improved Bench Planes;* Ebenezer Mathers, Morgantown, Virginia.

Claim.—"The construction of bench planes with the stock in two pieces connected by a metal cap."

25. For an *Improvement in Railroad Car Seats;* George T. M'Laughlin, Boston, Massachusetts.

Claim.—"Connecting the back of a railroad car seat with the body of the chair by means of springs and catches or their equivalents, whereby the back is made self-elevating when relieved from the catch which holds it. Also, in combination with the chair seat and its support, the annular ring, for the double purpose of a spring for the seat, and to prevent the seat from unnecessarily moving or rocking on its support when occupied."

26. For an *Improvement in Handle for Vise;* John T. Ogden, Boston, Mass.

Claim.—"Uniting the vise handle with the head of the screw by means of the swivel joint."

27. For an *Improvement in Scythe Rifles;* Eugene J. Post, Vienna, New Jersey.

Claim.—"Corrugating the surfaces of the scythe rifles."

28. For *Improved Method of Bottling Fluids under Gaseous Pressure;* Alphonse Quantin, Philadelphia, Pennsylvania.

Claim.—"The compound apparatus, composed of metal or other substances, to introduce a certain portion of a liquid into the apparatus, and force it out by the action of another liquid, gaseous or fermented."

29. For an *Improvement in Lamps for Burning Resin Oil;* Prentice Sargent, Newburyport, Massachusetts.

Claim.—"The annular air reservoir, in combination with the entry space and inwardly projecting lips, for the purpose of rendering the outer draft sufficiently constant to prevent the smoking of the lamp by any gusts of air or sudden movement to which the lamp may ordinarily be subjected. Also, the fine apertures or meshes opening into an outer chamber, in combination with said chamber, and with an inner perforated or recticular partition separating said chamber from the inner draft tube."

30. For an *Improvement in Machines for Pegging Boots and Shoes;* George Schuh and Phineas L. Slayton, Madison, Indiana.

Claim.—"1st, Feeding the boot or shoe to the plungers so that it may be punched and pegged by means of the combination of the screw, plates, shaft, frame, and pins. 2d, Punching the necessary holes in the sole and driving the pegs therein by means of the plungers fitted within separate cylinders—the points and awls on one plunger making the necessary holes in the sole at one stroke, and the other plunger being driven down and forcing the pegs in the sole by the plunger at its succeeding stroke. 3d, The friction block, operated by the cam, for the purpose of regulating the stroke of the plunger, and also the force of its blow."

31. For an *Improved Mode of Attaching Hubs to Axles;* Horace B. Simonds, West Hartford, Vermont.

Claim.—"Securing the hub upon the arm by means of the clutch, screw, and cap or box; the inner end of the clutch being of semi-cylindrical form and having a flanch on it, which flanch is fitted in a groove in the outer end of the arm, the screw passing through the outer end of the hub into the clutch; and the back part of the arm having a collar upon it, which collar is fitted in the back end of the hub; said collar being covered by a cap or box having a washer within it."

32. For an *Improvement in Air Escapes for Pumps;* Hiram Smith, Norwalk, Ohio.

Claim.—"The employment of tubes arranged to take the accumulating air from the top or upper portion of the receiving valve chambers and conduct it below the valve seats into the water discharge of the pump."

33. For an *Improvement in Gang Ploughs;* Aaron and Thomas S. Smith, Troy, Illinois.

Claim.—"Combining the axle and wheel with the bed piece."

34. For an *Improvement in Corn Shellers;* Jeremiah P. Smith, Hummelstown, Pa.

Claim.—"Grooving the shelling cylinder around its periphery, and extending the teeth of the breast beam therein, in combination with the arrangement for adjusting said breast beam to different degrees of inclination to suit the different conditions of corn to be shelled."

35. For an *Improvement in Tanning Apparatus;* Abraham Steers, Medina, N. Y.

Claim.—"The apparatus to charge the skins stretched on a frame, with a stratum of tan liquor."

36. For an *Improvement in Candle Dipping Machines;* Vincenzo Squarza, City of New York.

Claim.—"1st, The employment of intermittently rotating vertical wheels, carrying a number of wick frames, or wick holders, in combination with a rising and falling dipping trough. 2d, Keeping the dipping trough supplied to the proper level with tallow,

from a reservoir above by a valve, which is opened by the trough, or by some attachment thereto, every time it rises. 3d, The method of regulating the supply of tallow to the dipping trough, to make up exactly for the quantity taken therefrom by dipping, by the employment of two or more arms arranged at different elevations on a pivot attached to the trough, so that either one of them can be turned to a proper position to lift the valve in the reservoir. 4th, I claim the employment, for the purpose of tapering off the points of the candles, of a trough of hot water, into which the candles are plunged by the raising of the said trough, while the candles are stationary. 5th, The construction of the wick frames in pairs, each pair consisting of a shaft carrying two fixed bars, two sliding, to which are attached two pairs of clamping bars, and two wick boxes, all arranged so that each frame of the pair may, in its turn, be supplied with wick as required, to commence a new batch of candles. 6th, Constructing the draw plates in two parts, attached each to the jaw or jaws of one or more pairs of nippers, whether attached rigidly or to rollers fitted to the said jaws. 7th, The swinging frame with its jaws and rotary cutters, operating to take hold of the candles and cut them off when finished. 8th, The arrangement and combination of the table which carries the boxes, and the jaws which take the finished candles; that is to say, having both the table and jaws on shafts or centres, and gearing them together, so that they will move in such a way as to deposit the candles in the boxes gently and without injury."

37. For an *Improvement in Ships' Capstans;* Daniel and George Fallcot, Oswego, New York.

Claim.—"The arrangement of the ratchet fastened to the gear, with the ratchet on the barrel, and the traversing pawls in the head for the purpose of locking the head to, and releasing it from, each of the ratchets."

38. For an *Improvement in Guitars;* William B. Tilton, City of New York.

Claim.—"The combination of the bridge and rim of a guitar, or other stringed instruments, by a tail-piece being firmly attached to both, by which much of the strain is taken from the bridge-tree, and its size greatly reduced, by which the tone of the instrument is improved."

39. For *Improved Method of Adjusting Circular Saws;* Andrew L. Whiteley, St. Louis, Missouri.

Claim.—"The adjusting of the two saws at the same time towards each other, by means of the swinging arm and its set screws, and without allowing any end-play to the shaft. 2d, The combination of the device above claimed, with the devices for the purpose of adjusting the saw in every direction. 3d, So constructing the adjusting mechanism that it follows the shaft, when moved around on the arcs."

40. For an *Improvement in the Application of Soles to Boots and Shoes by means of Pressure and Gutta Percha, or other Cement;* Sylvanus H. Whorf, Roxbury, and Charles Rice, Boston, Massachusetts.

Claim.—"An improvement in the process of manufacturing and finishing shoes, with either gutta percha soles, or soles formed of leather or other material, and united to the upper and insole by means of gutta percha, and through the agency of pressing mechanism; our improvement consisting in applying heat within a last, by means of a chamber, and pipe, and steam, or means of heating said last, the same not only enabling the gutta percha of the sole to be softened, or rendered adhesive, while it is being pressed upon the insole and upper, but also serving to smooth and finish the upper."

41. For an *Improvement in Heading Bolts;* George Woodward, Brunswick, Maine.

Claim.—"The two oscillating shanks or levers, when combined with the suspended and bent toggles, and the perforated treadle."

42. For an *Improvement in Weighing Scale Beams;* William Yost, Goshen, Ohio.

Claim.—"The index marked from the centre, both right and left, together with the P, and its additions and weights, for grain measure."

43 For an *Improvement in the Construction of Grand Pianos;* Daniel F. Haasz, Philadelphia, Pa.

Claim.—"1st, The combining the action of grand pianos with a radiating key-frame, in such a manner as to enable me to use a deep and strong pin block. 2d, The key, with its projection and arrester, in combination with the lever and catches."

44. For an *Improved Mode of Constructing Cast Iron Pavement;* Peletiah M. Hutton, Troy, New York.

Claim.—"1st, Making an iron pavement of double thickness, or of two courses of iron plates, one resting upon the other. 2d, Fastening the two courses of iron plates together vertically, by means of the three-way adjustable key. 3d, Attaching the two courses of iron plates, laterally, by means of the pins cast on the upper surface of the lower plates, and the holes cast through the upper plates corresponding thereto. 4th, Also, the manner of forming and arranging the two courses of iron plates so as to produce the following results: That the joints formed by the edges with the upper course of plates are in no case parallel to the joints of the lower course of plates, and where the joints of the two courses of plates cross each other, they do so at right angles, in all cases."

MARCH 11.

45. For an *Improvement in Railroad Car Brakes;* Vincent Barnes, Washington, District of Columbia.

Claim.—"The attaching the frame or brake to the truck by the parallel levers, so as to form a self-acting reversable brake."

46. For an *Improved Hot Blast Furnace;* La Fayette Blair, Painesville, Ohio.

Claim.—"The tunnels, diaphragms, division plate, and casing."

47. For an *Improvement in Valves for Lock Gates;* William Butler, Little Falls, N. Y.

Claim.—"The combination of the flanch valve and slide valve, when said flanch valve is hinged to the lower end of the valve."

48. For *Improved Ore Washer;* William L. Carter, Marietta, Pennsylvania.

Claim.—"A conical vessel, provided with shovels and pins, or projections, whose shaft is horizontal, and lower side inclined, so that water introduced at one end shall have a natural flow to the other end, and meet the ores as they pass in an opposite direction, to wash them."

49. For an *Improvement in the Manufacture of India Rubber Belting or Banding;* John H. Cheever, Boston, Massachusetts.

Claim.—"The improvement in the manufacture of rubber belting or banding, which consists in compounding the fibres of cotton or flax with india rubber."

50. For an *Improved Bench Clamp;* Clinton W. Clapp, Nappinger's Falls, New York.

Claim.—"The hook attached to the shank, which is formed of two parts, having beveled ends and connected; the shank being fitted in the groove in the bench, and used in connexion with the stationary hook."

51. For an *Improvement in Washing Machines;* Edwin B. Clement and Silas G. Willie, Burnet, Vermont.

Claim—"The saw-teeth-shaped rubbers."

52. For an *Improved Apparatus for Heating Buildings by Steam;* Charles Davenport, Watertown, Massachusetts.

Claim.—"So connecting the float with the dampers of both the draft and smoke flues, by means of the chains, or their equivalents, that the pressure of steam within the boiler may be graduated to the temperature of the atmosphere, and the degree of heat required within the building. Also, so connecting the float, which actuates the dampers of the draft and smoke flues, with the cock which admits water from the supply cistern to the boiler, by means of the lever or its equivalent, that while the float is left free to rise to any required distance, it will open the cock whenever the water falls below its level."

53. For an *Improvement in Sewing Machines;* Henry R. David, City of New York.

Claim.—"The method of leading the thread, to avoid wear or derangement thereto, by combining with the slide in the patent of David M. Smith, of 16th April, 1850, on which this is an improvement, the needle constructed with two eyes, and the groove."

54. For an *Improvement in Machinery for Preparing Hemp and Flax;* Nancy Davy, Executrix of Edward Davy, deceased, Crediton, England; patented in England, November 13, 1852.

Claim.—"The reciprocating plate or plates, in combination with holding or retaining rollers, for effecting the separating of the fibres of the flax or hemp. Also, the combination of the hackle bar with the rollers and reciprocating breakers or plates."

55. For an *Improved Apparatus for Preventing Horses in Carriages from Falling;* Robert D. Dwyer, Richmond, Virginia.

Claim.—"The application of a suitable projecting frame, attached to the most convenient part of the carriage, or to the carriage or front axle, projecting over and between the horn or horns, sufficiently far, and at a suitable distance above, so that straps, chains, or other suitable fastenings, can be attached to the harness round the body of the horse, and to the collar."

56. For an *Improvement in Parallel Rulers;* R. Eickemeyer, Yonkers, New York.

Claim.—"Providing the ruler with a movable foot-piece and suitable stops."

57. For an *Improvement in the Preparation of Tallow for Making Candles;* François Garçin, Philadelphia, Pennsylvania.

Claim.—"The method of bleaching and purifying fat or tallow, for the purpose of making candles; the same consisting in the use of reduced nitric and sulphuric acids, alcohol, creta, gallica, slacked lime, camphor, borax, egg-shells, and oil of lemon."

58. For an *Improvement in Spark Conductors for Locomotive Trains;* Peter C. Guiou, Cincinnati, Ohio.

Claim.—"The yoke with the springs and the frame, so that the pipe shall have free space and liberty to play by the yielding of the springs, to accommodate the rocking motion of the cars, or the up and down motion, without cramping or injuring the pipe, and also to give room for the back and forward motion allowed by the car coupling."

59. For an *Improvement in Tanning;* R. Gould, Whitewater, Wisconsin.

Claim.—"To have discovered, that in order to insure the proper exercise of the properties of substances in tanning, they must be used in a certain manner, differing from the mode in which they have hitherto been known to be used. Also, to have discovered, that in order to use these substances effectively for tanning, they must be employed substantially according to the processes set forth in my application. Also, to have discovered, that when these three substances, or their chemical equivalents, have been employed together, they have and must fail, as they are, to some extent, incompatible, when so used. Also, the use, in the process of tanning of hides and skins, for the making of leather, of the two solutions described, and applied, each separately or at different times, and in the order following, viz: 1st, By using a combined solution of catechu, (or any other material, its equivalent, as containing the tannin properties,) and saltpetre. 2d, By using a combined solution of catachu, (or any other material, its equivalent, as containing the tannin properties,) and alum."

60. For an *Improvement in Carriage Tops;* Henry Hays, Quincy, Illinois.

Claim.—"The plate or circle, having the slat iron of the front bow projecting from it, working on a pinion in the standard, in connexion with a spring latch or pawl, fitting into notches in the plate, by means of which the top of the carriage is sustained in an elevated or half elevated position."

61. For an *Improvement in Machinery for Ironing Hats;* Samuel A. Kinsman and Samuel Field, Barré, Massachusetts.

Claim.—"Arranging the cam, so that when operated by the gear, it will control the vertical movement of the hat-block, through levers, in combination with the lever to control the lateral movements of the hat-block, and thus secure the adequate pressure on all parts of the hat at one time.

62. For an *Improvement in Harvester Cutters;* Israel S. Love, Beloit, Wisconsin.

Claim.—"The use of the clearing tooth, in connexion with the cutting tooth, provided with cutters distinct, and the spaces between them, continue back to the rear of the cutter bar. I do not limit myself to the exact form or proportions of cutter, for it is evident that either of them might be slightly varied, without materially altering the effect."

63. For an *Improved Spirit Blow Pipe;* Horatio N. Macomber, Lynn, Mass.

Claim.—"Combining with a vapor jet of a spirit blow pipe an air jet, that air may be blown from the lungs of a person, directly into the inflamed current of said vapor jet, in order to control, elongate, or reduce said current and increase its heating powers. Also, arranging the air jet concentrically within the vapor jet, in order that the effluent current of air may pass into a hollow tube, or stream of vapor or flame. Also, combining with each main jet tube, a lighting vapor jet tube."

64. For an *Improvement in Mowing Machines;* Jacob J. Mann, Westville, Indiana.

Claim.—"The construction of the reel frame, the same being braced by the rod, and the suspension of the reel, at the outer extremity of the shaft by the pendant."

65. For an *Improved Method of Bending Wood;* John C. Morris, Cincinnati, Ohio.

Claim.—"The clamps to prevent end expansion, and the levers, working on fixed fulcrums, when in operation."

66. For an *Improvement in Revolving Fire Arms;* Frederick Newbury, Albany, New York.

Claim.—"The combination of the wheel, gearing, and pawl, with the trigger, by which means the block is revolved. Also, the priming cap magazine, in combination with the trigger, to permit the capping of the cone by the trigger. Also, the spring guard plate, to prevent the fire from the upper chamber extending to the lower. Also, the combination of the picker attached to the hammer, with the apparatus operated by the thumb, in the act of cocking the hammer."

67. For an *Improvement in Carriage Hubs;* Henry Nycum, Uniontown, Penna.

Claim.—"A hub, composed of a back and front section, and having a thin metallic tube or ring independent of each, centrally placed between them, against which the inner ends of the spokes abut, when said sections are so made, that in removing the back one, the pipe or box of the hub shall also be removed or removable with it, to facilitate the properly introducing of a new spoke."

68. For an *Improvement in Steam Boilers;* Leonard Phleger, Tamaqua, Penna.

Claim.—"1st, The arrangement of the arched water space, so that the boiler may be suspended near to the track. 2d, The arrangement of the arched water space—the water space—and the water table in combination, so that the flame and heat will be reverberated."

69. For an *Improvement in Grain and Grass Harvesters;* Benjamin T. Roney, Philadelphia, Pennsylvania.

Claim.—"The gear frame with its lugs and beveled projections."

70. For an *Improvement in Straw Cutters;* Edwin P. Russell, Manlius, N. York.

Claim.—"1st, The wheels with the rim cams on the inside of the rim, in combination with friction rollers, for raising the box, with the knife attached, and causing it to pass the edge of the stationary knife, which is placed in such a position as to give them the shear cut. 2d, Setting the box at any angle of about 45 degrees, and hung on a hinge or pivot, with a joint or hinge in the bottom, for feeding the straw to the knives, and for allowing the knife to cut."

71. For an *Improvement in Lime Kilns;* Job Sands, Sands' Mills, N. York.

Claim.—"Having the fire chamber of the kiln so constructed, that the bottom will be but a short distance below the door, no grate bars being employed, and having an aperture made through the door, so that the air that feeds the fire will act horizontally upon it and nearly in line with the openings."

72. For an *Improvement in Puddling Iron;* Richard Savary, Steubenville, Ohio.

Claim.—"The arrangement of the cupola and puddling furnaces."

73. For an *Improved Method of Straining Mulley Saws;* Theodore Sharp, North Greenbush, New York.

Claim.—"Straining the saw, by attaching its ends to a pivoted elastic bar."

74. For an *Improvement in Apparatus for Heating or Cooking by Gas;* William F. Shaw, Boston, Mass.

Claim.—"The application of a cone or dome, formed of wire gauze, or pierced metal, to an ordinary wire gauze gas burner, for burning mixed gases and air, in combination with an outer cylinder of wire gauze, or pierced metal, for the supply of atmospheric air, divided into jets."

75. For *Improved Boxes for Axles;* Alfred E. Smith, Bronxville, New York.

Claim.—"The combination of two or more longitudinal narrow slots, cut in the direction parallel to the axis of the box, with enlarged longitudinal cavities."

76. For a *Mortising and Boring Machine;* George N. Sterns, Syracuse, New York.

Claim.—"1st, An adjustable cam, in combination with levers, spring, pawl, pinions, and rack. 2d, The use of the spring, or its equivalent, to move the clutch which gives the return motion to the auger."

77. For an *Improved Mode of Securing Thills to Axles;* Matthias Soverel, Orange, New Jersey.

Claim.—"The combination of the spiral spring and the catch or nut, and the eye of the bolt, and the spring chamber and slots."

78. For an *Improvement in Apparatus for Making Extracts;* Abraham Steers, Medina, New York.

Claim.—"The displacing apparatus, in connexion with the application thereto of heating and cooling agents, viz: the said apparatus being composed of the percolator and the receiver, separated from each other by means of a perforated diaphragm, or its equivalent, the said percolator having its upper end closed by a metallic cover, supplied with an outwardly opening valve, at the same time that the top of said percolator is connected directly with the said evaporating receiver, by means of a pipe, supplied with a valve or a stop-cock, by which arrangement, the contents of said percolator can be operated upon, first by steam generated in the evaporating receiver, and then by the percolation of the menstruum after it has been evaporated and condensed again."

79. For an *Improvement in Means for Reducing the Friction of Slide Valves of Steam Engines;* Robert L. Stevens, Hoboken, N. J.

Claim.—"The box or balance block, in combination with an ordinary slide valve—said balance block having around the edges of its upper face, ledges, which project upward, and are made to fit (around the whole upper face) into a recess in the follower, and formed by double ledges projecting down from, and enclosing, which recess has an india rubber packing in its bottom, against which the said ledges are made to pack steam tight, together with another india rubber joint at the bottom of another similar recess formed by the ledges and a part of the bonnet, into which latter recess, one of the ledges of the follower fits tight in the same manner as the ledges fit in the recess."

80. For an *Improvement in Revolving Fire Arms;* William Mt. Storm, City of New York.

Claim.—"1st, Extending the "casque" forward as far as the face of the cylinder, and surrounding it to form a receptacle or holder for it, while loading, in combination with a hinged apron piece. 2d, In combination with the so arranged barrel and casque, and for locking them together, the solid "self-acting locking spring, (as distinguished from a locking lever, having by necessity a hinge to wear loose, &c.,) said spring being arranged to resist the discharge by its direct tensible strength. 3d, In combination with the casque, or cylinder receptacle, the "safety-screw," projecting into the recess between the shoulders, (or as equivalent, the screw on the cylinder, and the shoulders on the "casque,") to prevent the cylinder from getting dropped, while loading or capping in action. 4th, The central revolving shaft, with the button head forward of the sleeve, and both projecting within the central cavity of the cylinder, beyond the line of its rear and the fire of the cap, in combination with a revolving wheel, located within the stock, enclosed from the fire and smoke. 5th, In combination with the "dog," having an inclined plane or projection at its forward end, to meet the purpose of such combination, an adjustable "tripping screw," whereby despite of wear, &c., the detachment of the "dog" from the sear, may be effected sooner or later, in accordance with the needed distance of revolution of the many chambered cylinder. 6th, Extending the rear of said "dog" downward from where it connects to the heel of the hammer, and connecting the "pawl"

directly thereto, by which means, the pull on the dog by the trigger, directly operates the parts to push around the cylinder. 7th, Extending the pawl beyond where it is connected to the downward extension or heel of the dog, and connecting the main spring to the part so extended, by which means the pull of the dog on the pawl, distends the main spring, while the latter being distended, presses the point of the pawl more firmly into the revolving holes or indentations in the face of the revolving wheel, preventing any slip, while the revolving cylinder in all points, rendering the use of a pawl spring unnecessary. 8th, Pivoting the usually fixed end of the main spring, so that while stationary, it shall not be fixed, but free to compensate for its own vibration, and that of the rear of the pawl, thus rendering the use of the usual vibrating or connecting "link" between the main spring and the rest of the block unnecessary, despite of the immediate connexion of the main spring to said pawl. 9th, The locking notches in the revolving wheel, or its equivalent, in combination with the "crest" on the dog, for the purpose of securing the stoppage and locking fast of the cylinder, at the proper position for discharge. 10th, In combination with the forward shoulder or detent on the head or sear of the trigger, the screw projections or detent on the rear of the head or sear of said trigger, to the end, that after said forward detent or hook ceases to act, by the dog being thrown off to lock the revolving wheel, and thereby, the cylinder in place, the hammer shall not immediately fall, but be retained "on cock" to give opportunity for deliberate aim as explained, said rear projection or detent catching at this point on the downward prolongation of the heel of the hammer, for this purpose, the whole being arranged and acting in conjunction."

81. For a *Machine for Cutting Irregular Forms;* Henry D. Stover and James W. Bicknell, Boston, Mass.

Claim.—"Combining the guide with the bearing, and also combining the cutter head with this guide, in such a manner that they shall move up and down together. Also, the combination of the cutter head, arbor and pivoted bearing, so as to allow the cutting angle of the knives to be varied in relation to the table, and also, combining them with the mechanism for varying that angle gradually in the cutting process."

82. For an *Improvement in Harvester Cutters;* Pliny Thayer, Lansingburg, N. Y.

Claim.—"In combination with the plates lying loosely on the fingers or guards, but kept from moving, by the projections of the plates, and the open countersinks on the guards, the cutters which are vibrated past those, and held to them by the guides and springs."

83. For an *Improved Plane Stock;* John B. Thomas, Cincinnati, Ohio.

Claim.—"The glass face, combined with the case or ferrule, or its equivalent."

84. For an *Improved Wrench;* Erastus Tracy, Troy, New York.

Claim.—"Making the movable jaw in two sections pivoted together, one of which sections contains the shank, and the other forms the clutch, by which the whole jaw is held to the shank, and both sections made united."

85. For an *Improved Fountain Pen;* A. F. and C. M. H. Warren, Brooklyn, N. Y.

Claim.—"1st, Having the piston and rod arranged, so that the piston may be detached from the rod, when the tube or fountain is filled with ink. 2d, Attaching the pen directly to the lower end of the tube by the band, conducting the ink from the tube to the back or convex side of the pen, by the wire which is attached to the pen, and passes through the apertures. 3d, The plate attached to the back or convex side of the pen, in combination with the wire, for the purpose of ensuring a regular and even supply of ink to the pen."

86. For an *Improved Machine for Cutting Out and "Skiving" the Soles of Boots and Shoes, and also for Cutting the "Rands" therein;* William Wells and Mellen Bray, Turner, Maine.

Claim.—"Operating the knife, which is attached to the bar, by means of the lever rod, with plate attached, on which plate the bar rests, and the ledge on the heel of the stock. Also, the knives, when attached to, or connected with, an elastic platform."

87. For an *Improved Dove-tailing Machine;* Edwin Wight, Philadelphia, Penna.

Claim.—"The cutting of dove-tails of exactly similar size and form, on the edges of a number of boards, at one operation, by placing said boards one upon the other, and submitting them to the action of revolving and traversing cutters."

88. For an *Improvement in Grain and Grass Harvesters;* Abner Whitely, Springfield, Ohio.

Claim.—"1st, The narrow divider. 2d, Making the divider with that portion forming the under or upper side of the slot removed as the case may be. 3d, Terminating, the shoe at or near the point of the blade which cuts against it, to prevent it carrying grass. 4th, Extending of the tops of the guards over the edges of the lower portions. 5th, The double cap, *i. e.*, the caps of two guards in one piece, having one shank for attaching it to the finger piece. 6th, Attaching the shanks of the guard caps to the finger piece, for the purpose of preventing straws or blades being carried beyond them to cause clogging. 7th, Terminating the points of the finger or fingers, at or near the points of the blades. 8th, Making one side and also one edge of the cutter bar, or either of them, a rasp or rough surface."

89. For an *Improved Faucet;* Moses Woodbury, Boston, Mass.

Claim.—"The combination of the handle with the stem, and the spring, when the latter is placed behind the valve."

90. For an *Improvement in Leather Splitting Machines;* Elisha Pratt, Assignor (through Pratt & Upton) to E. Pratt & Thomas P. Pingree, Salem, Mass.

Claim.—"So hanging and arranging the lower roll, by means of the levers, connecting rods, and plates, that it may be depressed when required, for the purpose of relieving and adjusting the hide."

91. For an *Improvement in the Manufacture of Umbrella Ribs;* Charles C. Reed, Assignor to self, William S. Reinert and Jacob Schnell, Philadelphia, Penna.

Claim.—"The manufacture of umbrella ribs, by grooving a cheap material, such as hickory, bamboo, or rattan, and securing within the groove a strip of whale bone."

92. For an *Improvement in the Manufacture of Boot and Shoe Soles;* Lorenzo Stratton, Feltonville, Mass., Assignor to self and Luther Hill, Stoneham, Mass.

Claim.—"The improvement in the manufacture of boot and shoe soles, viz: striking them up in nuts between formers and counter formers."

93. For an *Improvement in Sewing Machines;* William C. Watson, Assignor to Ira W. Gregory, City of New York.

Claim.—"1st, The tongue or spring, in combination with the needle, for insuring the formation of loops on one side only. 2d, The gripper, for seizing the thread and holding it, until the needle has entered the cloth, thus securing the last stitch against slacking up."

94. For an *Improved Method of Boxing Carriage Wheels;* Charles Schmidt, Union, Maine.

Claim.—"The method of boxing carriage wheels."

MECHANICS, PHYSICS, AND CHEMISTRY.

*Manufacture of Steel by Electricity.**

In contradistinction to the ordinary method of manufacturing steel, it may now be stated that a process has been discovered of converting iron into steel by a current of electricity passed through the iron when placed in a furnace, and embedded in charcoal, whereby an immense saving of both time and fuel is the more immediate result. The furnaces used in the instance now referred to, were fitted with two distinctly separate and independent compartments or boxes. One was filled with the common Swedish or bar iron, and the other with scrap and bar iron, indiscriminately mixed in about equal proportions: the former was intended to be

*From the London Mining Journal, No. 1047.

not so highly carbonized as the latter. The battery was placed, and generally so arranged, that the electric current should pass either through both, or through only one, of these compartments respectively, as required. After the furnace had been brought to the proper temperature, which occupied the usual time, the battery was set in action: the electric current was passed through both boxes simultaneously for 24 hours, when a trial bar was drawn from the box which contained the bar iron required in only the lesser degree to be carbonized. From the various tests to which this bar was subjected, it was found to be sufficiently carbonized, or converted into steel, although it was deemed expedient that the action of the current of electricity should be continued during another six hours, for "soaking," making the entire period 30 hours continuously. The current was then applied to the remaining box or compartment alone for 72 hours in addition, at the expiration of which time the action of the battery was suspended, and the furnace was allowed gradually to cool. Highly carbonized steel was found to have resulted, which was thus produced through continuous electrical agency. That quantity of iron which for the longest period had been subjected to the electric current was found in the highest degree to possess the respective qualities of hardness and carbonization. On the second experiment, which was intended to reduce the operation of the manufacture of steel within the nearest possible limit of time, the furnace, accordingly, was charged with foreign iron required to be highly carbonized, of a quality fitted (say) for the manufacture of files. On subjecting the furnace to the customary heat (the usual time being 64 hours firing,) the electric current was applied, and maintained in continuous action during the space of 48 hours, at the end of which time the battery was taken off, and the firing carried on for six hours longer. A trial bar was then drawn from the furnace, after the battery had been in action during 45 hours; and, from the appearance which the metal then presented, it was judged to have been sufficiently carbonized, excepting that six hours' extra firing was allowed for what is technically termed "soaking," or, rather, for the diffusion of carbon throughout the integral substance of the iron, which, in the process of converting, is received in the greater or lesser degree—in some places more than in others. After the necessary time had been allowed for cooling, the steel was taken out of the furnace, which discovered that portions of the metal were wanting in the required uniformity, whereas others possessed an undue degree or amount of hardness, which showed that either the battery was not applied at a sufficiently early stage, or that a few hours were wanting in the "soaking" process. It was, however, concluded that, had this operation been continued for six, or even for twelve hours longer, the result would have secured more perfect uniformity throughout the entire bulk of metal, and a saving, by this process of manufacture through the continuous electric current, amounting to at least 20 per cent. in labor, time, and fuel.

The results of these experiments have, however, demonstrated that, in the manufacture of iron, the agency of electricity can be applied with immense advantage, since there is every reason to conclude, that iron can now be made through this process, even from ores, equal in purity to the finest iron at present imported. On the other hand, in the operation of

the conversion of iron into steel, it will give a greater power of governance to the operators, inasmuch as the application of the battery for a certain time will ensure a certain amount of carbon being taken up, absorbed, or concentrated and amalgamated with the iron; and thus, by increasing or diminishing the action of the battery, different qualities of steel will be produced, with a certainty, regularity, and efficiency which, hitherto, under the ordinary process of manufacture, has been the object wanting—the great desideratum sought after, as well as the end desired to be attained. The experiments were conducted at Sheffield, under the superintendence of Mr. Hunt, and in conjunction and conference with Messrs. Atkinson, of that place. If, on a more extended scale, the electric process should be found practicable, we may yet have cast iron mortars, guns, and ordnance, at once carbonized into steel, and lowered in rigidity, toughness, and ductility, as well as in tensile properties, to any degree or amount of temper.

On Working Steam Expansively in Marine Engines. By Mr. E. ALLEN.*

(Continued from page 202.)

It is proposed now to consider the effect of increasing the size of the engines for expansive working, as regards the *total weights* carried; and the following Table XV. gives the relative increase of weight resulting from an ordinary engine being increased in size from 1 to 1½, 2, 2½, and 3 times; also the proportionate quantity of coal consumed in a given time; the saving in weight of coal balancing the increase in weight of engines, where the proportion of coal is large. The two last columns give the ratios of time, and the proportionate number of days the coal would last in the respective cases, if the gross weights carried were kept the same.

The general results may be given as follows; that when the size of the engines is doubled, the gross weights of machinery and coal together are

	Increase.
Increased in Class 1, from 1·25 to 1·68 equal to	34 per cent.
" in Class 2, from 2·00 to 2·21 equal to	10½ "
" in Class 3, from 2·50 to 2·56 equal to	2½ "

and are

	Decrease.
Decreased in Class 4, from 5·00 to 4·34 equal to	13 per cent.
" in Class 5, from 8·00 to 6·47 equal to	19 "

Also, when the size of the engines is increased to 3 times, the gross weights of machinery and coal together are

	Increase.
Increased in Class 1, from 1·25 to 2·14 equal to	71 per cent.
" in Class 2, from 2·00 to 2·57 equal to	28½ "
" in Class 3, from 2·50 to 2·85 equal to	14 "

and are

	Decrease.
Decreased in Class 4, from 5·00 to 4·28 equal to	14 per cent.
" in Class 5, from 8·00 to 5·99 equal to	25 "

* From the Lond. Mechanics' Mag., Aug., 1855.

TABLE XV.

Table showing the Proportionate Weights of Machinery and Coal, and Joint Weights of same, when the size or Nominal Horse-Power of Engines is varied (Indicated Horse-power supposed the same in all cases respectively).

Class.	Service.	Ratios of Nominal Horse-power	* Ratios of Weight of Machinery corresponding to Increase of Nominal Horse-power.	Ratios of Weight of Coal corresponding to Increase of Nominal Horse-power.	Ratios of Total Weights	Ratios of Time the Coal would last if the Total Wts. be kept the same.	Ratio in Days.
1	River.	1	1·00	·25	1·25	1	2½
		1½	1·25	·20	1·45	. .	. .
		2	1·50	·18	1·68	. .	. .
		2½	1·75	·16	1·91	. .	. .
		3	2·00	·14	2·14	. .	. .
2	Coasting and Continental.	1	1·00	1·00	2·00	1·00	10
		1½	1·25	·81	2·06	·92	9
		2	1·50	·71	2·21	·70	7
		2½	1·75	·63	2·38	·39	4
		3	2·00	·57	2·57	·00	0
3	Ocean (Short Voyages) and Government.	1	1·00	1·50	2·50	1·00	15
		1½	1·25	1·21	2·46	1·03	15½
		2	1·50	1·06	2·56	·94	14
		2½	1·75	·94	2·69	·80	12
		3	2·00	·85	2·85	·59	9
4	Ocean (Long Voyages) Australian.	1	1·00	4·00	5·00	1·00	40
		1½	1·25	3·24	4·49	1·15	46
		2	1·50	2·84	4·34	1·23	49
		2½	1·75	2·52	4·27	1·29	51½
		3	2·00	2·28	4·28	1·31	52½
5	Ocean (Voyages out and home,) Eastern Steam NavigationCompany.	1	1·00	7·00	8·00	1·00	70
		1½	1·25	5·67	6·92	1·19	83
		2	1·50	4·97	6·47	1·30	91
		2½	1·75	4·41	6·16	1·41	99
		3	2·00	3·99	5·99	1·50	105

* The boilers, water, wheels, or screw are supposed the same, and the engines alone equal to half the gross weight of machinery.

The last columns show that in the 4th Class, where the weight of coal carried is equal to four times the gross weight of machinery, if the size of the engines be doubled, the same gross weight being taken, then the coals will last nine days longer—equal to 22 per cent. increase; and if the size of the engines be increased to three times, and the gross weight carried be kept the same, then the coal will last 12½ days longer—equal to 31 per cent. increase.

Also, in the 5th Class, where the weight of coal carried is equal to seven times the gross weight of machinery, if the size of the engines be doubled, the gross weight being kept the same, then the coal will last 21 days longer—equal to 30 per cent. increase; and if the size of the engines be increased to three times, and the gross weight carried be kept the same, then the coal will last 35 days longer—equal to 50 per cent. increase.

The last part of the subject to be now considered is, the effect which

the increase in the size of the engines has upon the *total spaces* occupied by machinery and coals together. Table XVI. gives the results, where the size increases from one to one and a half, two, two and a half, and three times, for the three divisions into which the five classes of vessels, before spoken of, are reduced.

In Class 1 the coals occupy a space *equal* to that occupied by the engines alone; in Classes 2 and 3, *three times;* and in Classes 4 and 5, *five times* the space occupied by the engines alone.

The space above spoken of is horizontal space, taken at the greatest beam of the vessels.

The general results are, that if the size of the engines be doubled, then the total space occupied by machinery and coals taken together (the coals lasting the same time in all cases),

In Class 1, increases from 4·00 to 4·21, equal to 5 per cent.
In Classes 2 and 3, decreases from 6·00 to 5·63, equal to 6 "
In Classes 4 and 5, decreases from 8·00 to 7·05, equal to 12 "

Also, if the size of the engines be increased three times, then the total space occupied by machinery and coals taken together,

In Class 1, increases from 4·00 to 4·57, equal to 14 per cent.
In Classes 2 and 3, decreases from 6·00 to 5·71, equal to 5 "
In Classes 4 and 5, decreases from 8·00 to 6·85, equal to 15 "

TABLE XVI.

Table showing the Relative Spaces occupied by Engines, Boilers, and Passages, and Coals, separately and together; the size of Nominal Horse-Power increasing from 1 to 3; the Actual or Indicated Horse-Power remaining the same.

Class.	Service.	Ratios of Size or Nominal Horse-power.	Ratios of Spaces occupied by Engines alone. *	Spaces occupied by Boilers and Passages (Constant.) †	Ratios of Spaces occupied by Coals. ‡	Ratios of Total Spaces.
1	River.	1	1·00	2	1·00	4·00
		1½	1·25	2	·81	4·06
		2	1·50	2	·71	4·21
		2½	1·75	2	·63	4·38
		3	2·00	2	·57	4·57
2 and 3	Coasting and Continental and Ocean (Short Voyages.)	1	1·00	2	3·00	6·00
		1½	1·25	2	2·43	5·68
		2	1·50	2	2·13	5·63
		2½	1·75	2	1·89	5·64
		3	2·00	2	1·71	5·71
4 and 5	Ocean (Long Voyages) and Eastern Steam Navigation Company's Vessels.	1	1·00	2	5·00	8·00
		1½	1·25	2	4·05	7·30
		2	1·50	2	3·55	7·05
		2½	1·75	2	3·15	6·90
		3	2·00	2	2·85	6·85

* The actual horizontal space occupied by engines may be taken generally at ¾ square foot per nominal horse-power.

† The actual space occupied by boilers may be taken at 1 square foot per nominal horse-power, and passages at ½ square foot.

‡ The space occupied by the coals varies,—Class 1, ¾ square foot; Classes 2 and 3, 2½ square feet; and Classes 4 and 5, 3¾ square feet per nominal horse-power.

Ratios—Engines, 1; Boilers and Passages, 2; Coals 1, 3, and 5 respectively.

Table XVII. shows how the *cargo space* is diminished or increased under the three suppositions, that the machinery and coal space is *equal* to the cargo space, or to *two-thirds*, or to *one-half* the cargo space; these proportions embracing the ordinary limits.

TABLE XVII.

Table showing the Per Centage of Loss or Gain in Cargo Space, and the Per Centage of Saving in Quantity of Coals required, when the size or Nominal Horse-power of the Engines is Increased, the Indicated Horse-power being the same.

Ratios of Total Spaces occupied by Machinery and Coals (from foregoing Table.)	The same Ratios, but showing the per centage of Increase or Decrease.	Per Centages in which the Cargo Space is Diminished or Increased.			Ratios of Coals consumed in the same time, and developing the same Power.	Per centage of Coal saved by Expansive Working.
		1st. When the total Machinery and Coal Space is *equal* to the total Cargo Space.	2d. When the total Machinery and Coal Space is ⅔ of the total Cargo Space.	3d. When the total Machinery and Coal Space is ½ of the total Cargo Space.		
4·00	100	Diminishes Per Cent.	Diminishes Per Cent.	Diminishes Per Cent.	100	Per Cent.
4·06	101½	1½	1	¾	81	19
4·21	105	5	3½	2½	71	29
4·38	109	9	6	4½	63	37
4·57	114	14	9½	7	57	43
6·00	100	Increases Per Cent.	Increases Per Cent.	Increases Per Cent.	100	Per Cent.
5·68	94	6	4	3	81	19
5·63	94	6	4	3	71	29
5·64	94	6	4	3	63	37
5·71	95	5	3½	2½	57	43
8·00	100	Increases Per Cent.	Increases Per Cent.	Increases Per Cent.	100	Per Cent.
7·30	91	9	6	4½	81	19
7·05	88	12	8	6	71	29
6·90	86	14	9½	7	63	37
6·85	85	15	10	7½	57	43

If the engines be doubled in size, then

In Class 1, the cargo space diminishes 5, 3½, and 2½ per cent.
In Classes 2 and 3, " " increases 6, 4, and 3 "
In Classes 4 and 5, " " increases 12, 8, and 6 "

If the engines be increased in size three times, then

In Class 1, the cargo space diminishes 14, 9½, and 7 per cent.
In Classes 2 and 3, " " increases 5, 3½, and 2½ "
In Classes 4 and 5, " " increases 15, 10, and 7½ "

The last column gives the per centage of saving in coal.

The effects of *increasing the size* or nominal horse-power of engines, for the purpose of working the steam more expansively, have now been considered, in respect both to the *increased first cost of machinery*, so far at least as the interest on the increased capital is concerned, the *saving of coal* in per centage of capital, the *increase of weight of machinery* and the *saving in weight of coal*, and also in respect to the *total spaces occu-*

pied by machinery and coal, and also the effect of the changes on the *cargo space* in per centage of the first supposed cargo space; and it is considered that the results are such as are not generally known, and that merchants and ship-owners are wholly unaware of the advantages of working steam expansively, even should they be compelled at the outset to pay double the amount now usually paid for engine power.

It would appear certain that if no alternative existed but that of increasing, say the diameter of the cylinders of marine engines, and thus increasing the first cost in about the proportion of $1\frac{1}{2}$ times for double the size, and 2 times for 3 times the size, (the boilers, wheels, or screw being supposed to remain the same,) ample reason still exists for making such a change in contracting for engines intended for vessels carrying a large proportion of coal; and it has been shown that if double the ordinary amount be paid for the machinery, yet $9\frac{1}{4}$ per cent. increase may be paid upon the capital in some cases, after deducting for the extra cost of engines, by the economy in coal alone.

It has also been shown that notwithstanding the increased size of engines (supposed to be increased three times,) the Australian vessels carrying a large proportion of coal, present opportunities of gaining 15 per cent. in many cases in cargo room, and further, that about 14 per cent. may be saved in the gross weights carried, taking machinery and coals together; or that so much more additional coal could be taken for a longer voyage without re-coaling.

In the foregoing Tables, the size or nominal horse-power of engines has been supposed to be increased three times, as a limit, but no advantage has been named as resulting from the diminished cost of the boilers, since, less steam being required to develop the same power, smaller boilers would suffice. Considerable advantage, however, would follow from this reduction; or advantages might be shown, in decrease of weight and space in the boilers; but it has been considered best not to encumber the calculations with so many considerations.

The gain in cargo space is altogether an additional saving to that already named as resulting from economy in quantity of coal, but this source of profit has only been shown in a per centage of increase of cargo space, and no money value can be set upon it, as it varies so much with the nature of the trade and freight obtained.

The following Table, XVIII., presents a general summary of what has been before stated, and it will be seen from this Table, that until the quantity of coals taken in proportion to weight of machinery at least equals $1\frac{1}{2}$ times, as in Class 3, or rather until it equals two times the gross weight of machinery, no change could be advantageously made by increasing the nominal horse-power or size of the engines; inasmuch as (on the conditions assumed) the weight of the machinery increases more rapidly than the weight of the coal diminishes.

In Classes 4 and 5, however, an *increase in the weight of the engines* is soon covered by the *reduction in weight of coal* required.

TABLE XVIII.—GENERAL SUMMARY.

Table compiled from the foregoing Tables, the size or Nominal Horse-power increasing from 1 *to* 2 *and* 3 *times (the intermediate sizes being omitted,) and based on the supposition that in order to work expansively the Engines must be increased in Cost, Weight, and Size, the Boilers being assumed to remain the same. The Steam Pressure supposed at only about* 20 *lbs. above the atmosphere.*

Class.	Service.	Ratio of Size or Nominal Horse-power.	Saving in Coal in per centage of capital.	Increase of Capital per cent.	Total Weights of Coal and Machinery—Increase or Decrease per cent.	Total Spaces occupied by Coal and Machinery—Increase or Decrease per cent.	Cargo Space, Decrease or Increase per cent.			Per Centage of Increase of Time the Coals would last, if the Total Weights be kept the same.	No. of Days the Coals will last, if Total Wts. bekept the same.
							When Total Machinery and Coal Space is *equal* to Cargo Space.	When Total Machinery and Coal Space is $\frac{2}{3}$ of Cargo Space.	When Total Machinery and Coal Space is $\frac{1}{2}$ of Cargo Space.		
			Per Cent	Per Cent	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Days.
1	River	1	...	...	Increases	Increases	Decreases	Decreases	Decreases	...	$2\frac{1}{2}$
		2	4·25	30	34	5	5	$3\frac{1}{3}$	$2\frac{1}{2}$	...	...
		3	6·45	60	71	14	14	$9\frac{1}{3}$	7	...	...
2	Continental	1	...	...	Increases	Decreases	Increases	Increases	Increases	...	10
		2	1·45	20	$10\frac{1}{3}$	6	6	4	3	...	...
		3	2·15	40	$28\frac{1}{2}$	5	5	$3\frac{1}{3}$	$2\frac{1}{2}$	...	...
3	Ocean (Short Voyage)	1	...	...	Increases	Decreases	Increases	Increases	Increases	...	15
		2	1·45	15	$2\frac{1}{2}$	6	6	4	3	...	...
		3	2·15	30	14	8	5	$3\frac{1}{3}$	$2\frac{1}{2}$	...	...
4	Ocean (Long Voyage)	1	...	...	Decreases	Decreases	Increases	Increases	Increases	...	40
		2	7·25	15	13	12	12	8	6	22	49
		3	1··75	30	14	15	15	10	$7\frac{1}{2}$	31	$52\frac{1}{2}$
5	Ocean (Voyage Out and Home)	1	...	...	Decreases	Decreases	Increases	Increases	Increases	...	70
		2	1·45	15	19	12	12	8	6	30	91
		3	2·15	30	25	15	15	10	$7\frac{1}{2}$	50	105

The increase in the weight of engines would be found to be about balanced by the decrease in weight of coal required, if the quantity of coal taken was equal to double the gross weight of machinery; the boilers being supposed to remain the same. In these calculations it must be remembered, that the boilers are supposed to remain the same, and the weight of the engines alone are supposed to increase in the ratio of $1\frac{1}{2}$ times the weight for double the size or nominal horse-power, and two times the weight for three times the size or nominal horse-power.

The importance of the gain in cargo-space, may be thus estimated, (taking the Australian vessels as an instance):—

Supposed capital of company, . .	£ 100	0	0
Working expenses supposed at 65 p. c., with the coals 25. p c.,	65	0	0
To pay 5 per cent. the receipts must be . .	70	0	0
With engines increased to three times size—			
The capital increased to . .	130	0	0
Working expenses reduced by saving of 43 per cent., off coals at 25 per cent., . .	54	5	0
To pay 5 per cent. the receipts need only be (£54 5 0 × £6 10 0) . . .	60	15	0

But the receipts on former supposition are £70, showing an addition of 7 per cent. on the increased capital, or $9\frac{1}{4}$ per cent. on the original supposed capital.

To this add from 7½ to 15, say 10 per cent. on receipts, extra cargo space, equal to £7.

This gives total receipts,	£ 77	0	0
Working expenses,	54	5	0
Balance for dividend,	£ 22	15	0

This on £130 equals 17½ per cent.

It can be shown also that with *improved machinery*, comparatively no extra capital would be needed, and that no additional space would be required in one engine room, so that a *saving of* 43 *per cent.* in coal would give 10¾ per cent. on capital in the case of Australian vessels, and add besides, from 13½ per cent. to 27 per cent.—say 18 per cent. to the cargo space, and consequently to the receipts—

Thus, capital,	£ 100	0	0
Working expenses reduced to	54	5	0
Receipts as before, £70, to which add 18 per cent. = £ 12 12 0			
for extra cargo space, making total receipts,	82	12	0
Leaving for dividend,	£ 28	7	0

(To be continued.)

For the Journal of the Franklin Institute.

On the Manner of Steering Steamers; and on Athwartship Bulkheads.

Board of Underwriters, *New York*, *Feb.* 11, 1856.

Dear Sir :—In consideration of the peril incurred, and injury sustained by the steamer *Persia* upon her last trip from Liverpool here, I beg leave to renew my suggestion of a previous date, regarding the manner of steering steamers, wherein I recommended that the owners of all steamers be required to have them steered forwards instead of aft, as is customary in our Atlantic Lines, and at the same time to invite your attention to the subject of athwartship bulkheads.

In order to present this subject of steering to you in as brief a manner as practicable, I submit the following summary of the elements of the case, and the advantages of such a change.

When a steamer is steered aft, there is required in addition to the officer of the watch, a second officer to be stationed aft, to communicate orders to the helmsman, the duty of look-outs being confided alone to the forecastle watch, and to the officer of the watch.

When the wheel is placed forward, the number of look-outs is increased by the addition of the second officer of the watch and the helmsman.

When an observation forward renders necessary immediate action with the wheel, the order is given from the forecastle to the officer of the watch; by him it is repeated to the officer of the wheel, and by him to the wheel; this course involving both a delay and ambiguity of interpretation that has in many cases proved fatal.

Regarding the construction and use of athwartship bulkheads, it is unnecessary for me to enter into any details, as the subject is at this time

so fully understood by you. All that is left for me to do, is to suggest that you adopt some course whereby an inducement is held out to the owners of steamers to fit their vessels with them. The example of a resort to them has been set in nearly all of the foreign iron steamers and in two of the New York and Havre Line, and I am gratified in being able to advise you, that upon an interview just had with E. K. Collins, Esq., he promptly declared his intention to have all the steamers of his line forthwith fitted with them.

The frequency of an obscure atmosphere arising from fogs and snow storms, and the presence of icebergs and ice, upon the principal steamer route, viz: between this port and England, and the great numbers of vessels traversing it, added to the character of the entire coast upon both sides, renders this route the most perilous of any open to navigators.

In view, then, of the existing dangers of this route, about to be increased by the addition of no less than five lines of steamers, I am of the opinion that your interests, aside from the dictates of humanity, render it imperative, that prompt action should be taken regarding the change proposed in steering and the adaptation of bulkheads enclosing the vessel into compartments.

I am, respectfully, your obedient servant,

CHARLES H. HASWELL, *Surveyor.*

A. B. NEILSON, Esq.,

President Board of Underwriters, New York.

For the Journal of the Franklin Institute.

On the Polar Open Sea. By T. W. BAKEWELL.

It is generally conceded, that for 8 or 10 degrees of latitude around the north pole, there exists a space clear of ice, "The open Polar Sea."

The doubts as to the fact arise from the apparent anomaly of a relaxation of icy feature, where we might reasonably expect increased rigor.

The following is offered as a contributing cause for this phenomenon:

The existence of an upper current from the pole southward, and a compensating under current, northward, is established beyond dispute.

Now, it will be observed, that in high latitudes, the centrifugal force, by the earth's rotation, acts in the direction (nearly) of a tangent to the surface, or horizontally, and that in the plane of any parallel of latitude, say 85°, the outer edge is driven more forcibly in said horizontal or southward direction, than any point further down the plane. Hence the upper southern flow from the pole, and the under compensating current northwards.

Centrifugal force at the equator is to gravity as ·003436 to 1, and is as the cosines of latitude.

That portion of the centrifugal force at any point in the plane of any cosine, which acts horizontally, is as radius to cosine.

The nett value of this force horizontally, after allowing for the small tangential angle is, at the outer edge of the plane ·000274 of gravity, and

at 5·8 miles down the plane ·000265 of gravity, or a difference of $3\frac{1}{3}$ per cent. But the 5·8 miles down the plane at 85° is only at the moderate depth of one mile (vertically) at 85° 5′.

Cincinnati, February, 1856.

For the Journal of the Franklin Institute.

Mechanical Engineering as applied to Farm Implements.

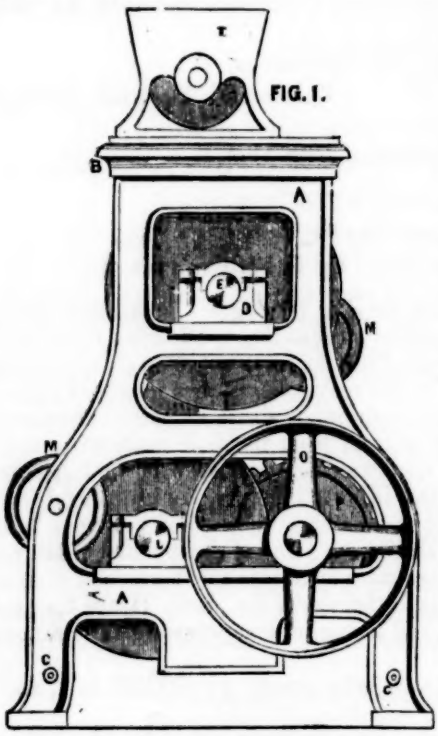
By H. Howson, Civ. Eng.

(Continued from page 190.)

Portable Flouring Mill of Messrs. Weis & Rau, of Bordentown, N. J.; patented by Mr. Joseph Weis, of that place.

This mill has attracted considerable attention on account of its diminutive size and general efficacy, which render it peculiarly well adapted for farm uses.

FIG. 1.



In reference to the annexed engravings, fig. 1, is an end elevation, showing the exterior of this mill. Fig. 2, a transverse section of the same. Fig. 3, a detached view of the shell and burr.

A A, are the two side frames of the machine which are connected together at the top by the entablature B; and towards the bottom by the cross-stays C.

To each of the frames A, are secured pedestals D, which form the bearings of the shaft E; to this is attached the circular tapering burr F, round which is tightly secured the cast steel covering Q, which may be formed of one piece, or of a series of hoops with their edges in contact with each other. The steel surface of the burr being first turned perfectly smooth, a series of teeth, similar to those of an ordinary coarse file, are cut thereon in disjointed lines obliquely with the axis of the burr.

H, is a semicircular tapering shield of cast iron, having flanches on each side, and notched so as to fit the guides I, which are parallel with

the axis of the burr; their ends being permanently secured to the inside of the opposite frames.

Three or more steel pieces *h*, are fitted in dove-tailed grooves, cut longitudinally inside the tapering shield H, so that their surfaces may assimilate to the circumference of the steel covered burr. Between each of the steel pieces *h*, are two longitudinal grooves *i*, for a purpose hereafter referred to.

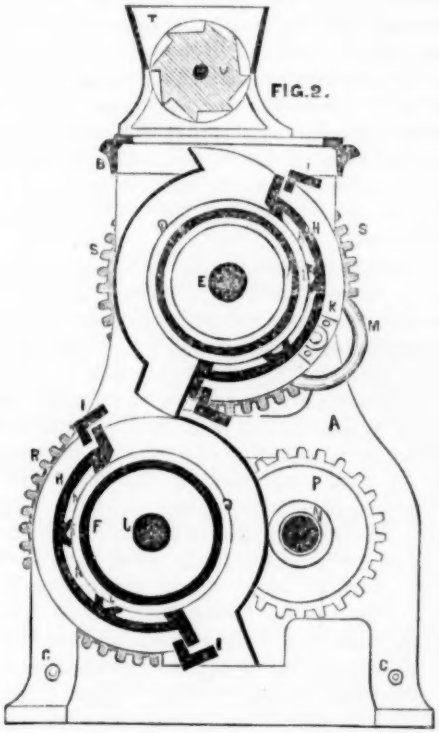


FIG. 2.

The concave surfaces of the steel pieces *h*, have likewise file teeth cut obliquely with the axis of the burr; the obliquity of the teeth on the burr, and those on the steel pieces *h*, being in contrary direction. Below the shaft E, is a second shaft J, which has also its bearings on the opposite frames of the machine. On this shaft is a tapering burr with steel covering, similar to that above described, and in proximity with this, is a tapering shield similar to that above referred to, and guided in ways I, in a similar manner.

In order to bring the concave surface of the semicircular shield and that of the steel covered burr closer to, or further from, each other, a nut K, is attached to the inside of one of the flanches of the shield for the reception of a screw, the end of the latter being connected to the frame A, so as to swivel therein without having any lateral movement. These screws are furnished with handle wheels M, so that on turning the screws by the same, the shields may be made to slide backwards and forwards on the ways I, and their steel pieces consequently be brought nearer to, or further from, the surfaces of the steel covered burrs.

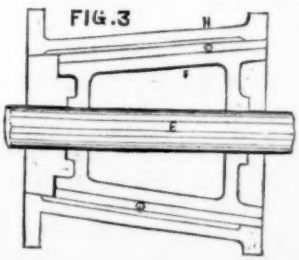


FIG. 3

N, is the driving shaft, having also its bearings on pedestals in the opposite frames A A. The shaft is furnished with a pulley O, on one side of the machine for receiving the driving strap, and has a spur wheel P, inside the frames, which gearing into a similar wheel Q, on the shaft J, causes the latter,

and with it the steel faced burr, to revolve. Outside the machine, the shaft J, is furnished with another spur wheel R, which gearing into the wheel S, on the shaft F, causes the upper burr likewise to revolve; so that on turning the pulley N, the upper and lower burr have a simultaneous movement imparted to them.

T, is the hopper secured to the top of the frame; and in the lower mouth of the hopper is the roller U, on the surface of which are a series of indentations *t*. The feed roller is attached to a shaft which has its bearings on the ends of the hopper, and is furnished with two or more different sized pulleys, round either of which may pass a strap from similar pulleys on the shaft E, so that the speed of the feed roller may be altered at pleasure.

The grain to be ground being placed in the hopper and the machine set in motion, the feed roller will turn; and the grain entering the indentations, will pass out in regular quantities into the circumference of the tapered steel covered roller F, at the point where the upper portion of the semicircular shield terminates.

The grain is now carried between the shield and the burr, and is acted upon by the oblique teeth on the pieces *h*, and those on the steel covering of the burr, and as these teeth slant in contrary directions, the cutting effect on the grain will be most efficient. This efficiency is increased by the longitudinal grooves *i*, which, as the burr revolves, catch the grain and turn its direction between each of the pieces *h*.

The grain thus partially ground, on leaving the point where the lower portion of the upper shield terminates, drops down a slide into the circumference of the lower burr, where it is again acted upon by the teeth on that burr and those on the shield, and being still further ground thereby, is discharged below into any convenient receptacle.

When it becomes necessary to grind the grain finer or coarser, by turning the wheels M, the shields may be brought in closer proximity with, or further from, the burrs, and the desired effect thereby obtained.

In order to prevent the grain from flying, the burrs are covered with guards of sheet iron, or other suitable material. The above mill does not occupy a space of more than 40 inches in height, and 28 inches in width; the burrs being 40 inches long, and 12 inches in diameter, at their largest ends.

(To be Continued.)

For the Journal of the Franklin Institute.

Experiments on Sound for the Application of Ringing Bells.

By JOHN W. NYSTROM.

A body set into vibration, to produce sound, will vibrate a proportionate number of times (per unit of time,) to the pitch of tone produced. Two bodies set into vibration, one twice as fast as the other, will produce what in musical language is called an *octave*, or the relative pitch of the two tones will be, one an *octave* above the other. Two bodies vibrating, one four times as fast as the other, will produce a relative pitch of two *octaves*. In music an *octave* is divided into thirteen parts, and the

number of vibrations per unit of time for each part will be terms in a geometrical progression, of which we know that the thirteenth term is double the first one. For our purpose it is only necessary to assume a certain number of vibrations per second for a given tone, and calculate the proportionate number for each tone within a desired limit. Assume the tone c, to make sixteen vibrations per second, the octave above will then make c = 32 vibrations in the same time. Now, referring to the formulæ in a geometrical progression in which we know $a=16$, the first term, $b=32$, the last or thirteenth term, and $n=13$, the number of terms. Required the ratio in the progression?

$$r = \sqrt[n-1]{\frac{b}{a}} = \sqrt[13-1]{\frac{32}{16}} = \sqrt[12]{2},$$

$$\text{or } \log r = \frac{\log 2}{12} = \frac{0{\cdot}30103}{12} = \log 1{\cdot}0595 \text{ the ratio.}$$

Let b represent the number of vibrations per second for any tone the order of which from c is n, we shall have

$$b = ar^{n-1} = 16 \times 1{\cdot}0595^{n-1}, \text{ or}$$

$$\log b = \log 16 + \log 1{\cdot}0595\ (n-1).$$

This is the formula by which the number of vibrations in the following table are calculated.

TABLE I.—*Variations per second.*

Key Note.	Bass.			Zero.	Descant.			Key Note.
	3d Oct.	2d Oct.	1st Oct.		1st Oct.	2d Oct.	3d Oct.	
C	16·000	32·000	64·000		128·00	256·00	512·00	C
C♯	16·947	33.895	67·790		135·58	271·16	542·32	C♯
D	17·960	35·920	71·840		143·68	287·63	574·72	D
D♯	19·027	38·055	76·110		152·22	304·44	608·88	D♯
E	20.159	40·318	80·636		161·27	322·54	645·09	E
F	21·357	42·725	85·430		170·86	341·72	683·44	F
F♯	22·627	45·255	90·510		181·02	362·04	724·08	F♯
G	23·972	47·945	95·890		191·78	383·56	767·12	G
G♯	25·398	50·797	101·590		203·19	406·37	812·75	G♯
A	26·908	53·817	107·630		215·27	430·53	861·07	A
A♯	28·508	57·017	114·030		228 07	456·13	912·27	A♯
B	30·204	60·409	120·820		241·63	483·27	966·54	B
C	32·000	64·000	128·000		256·00	512·00	1024·00	C

First Experiments.—The first experiments were made with brass and cast steel wire, fastened at one end in a bench-vise, and left free with the other end to vibrate when tolled near the vise. A wire thus in vibration will sound, what in musical language is called a *quinta*, or two distinct notes with a relative pitch of five divisions in the octave, as CG, GD, or FC, &c., &c., the table contains the highest note in the *quinta*.

TABLE II.

Cast Steel Wire.				Brass Wire.			
Diameter inches.	Length inches.	Number vibra'ns.	Key Note.	Diameter inches.	Length inches.	Number vibra'ns.	Key Note.
0·131	48	26·91	A	0·14	28	50·80	G♯
"	34	57·00	A♯	"	24	71·84	D
"	24	120·82	B	"	12	322·50	E
"	17	241·64	B	"	8·5	645·00	E
"	18	203·20	G♯	0·096	28	38·05	D♯
"	20·37	161·27	E	"	24	50·80	G♯
"	21·56	143·68	D	"	12	181·02	F♯
"	23	128·00	C	"	9	383·56	G
0·096	40	25·39	G♯	0·186	28	64·00	C

The preceding table contains the result of the first experiments, from which I have deduced the following formula for brass wires in which the letters denote,

n=number of vibrations per second of the wire.

d=diameter, and l = length of the vibrating wire in inches.

$$\log n = 0{\cdot}2\ (25+4\log d - 9\log l).$$

If the wire is made into a spiral, or ring with the ends soldered together, it will sound the same note as the same wire of a similar length when straight.

Second Experiments.—The second experiments were made with a number of *bell metal rings* of different sizes and compositions, cast in green sand at Merrick & Sons' Foundry. Also, two cast iron rings moulded from one pattern and cast one in green, and one in dry sand. The one cast in dry sand was four ounces heavier and sounded half a note sharper than the other.

The section of metal in the annular rings was rectangular; of which the thickness was the difference between the inner and outer radii, and height parallel to the axis of the ring. The diameter of the rings noted in the following table, is the mean of the inner and outer diameters, and measured from the inside of metal to the outside on the opposite side. The different composition of metal has but little effect on the pitch of tone, as from 8 C, 1 T, to 3 C, 1 T, it differs only one note; and for ordinary ringing bells, the composition of metal is generally from 27 to 30 pounds of tin to 100 pounds of copper. I have, therefore, omitted the composition in the following formulæ. The height of the rings has no influence on the pitch of tone, which will be seen in the following table. From these experiments I have deduced a formula by which to calculate the pitch of tone for rings of any size, but of composition from 3 to 4 copper, with one tin. Letters denote,

n=number of vibrations per second. t=thickness; and D=diameter of the ring in inches. Log n=0.2 (23·648003+4 log t—9 log. D).

TABLE III.—*Experiments with Bell Metal Rings.*

Composition of Metal.	Weight in ounces.	Height in inches.	Thickness in inches.	Diameter in inches.	Vibrations *n*.	Key Note.
8 C I T	124	1·875	0·4000	10·8125	76·11	D♯ high.
6 C I T	130	"	"	"	80·63	E
4 C I T	"	"	"	"	83·00	F low.
3 C I T	"	"	"	"	85·43	F
3 C I T	118	1·500	0·3800	11.0000	80·63	E
"	193	1·500	0·7500	10·6250	152·22	D♯
"	155	3·000	0·3125	10·7500	82·00	E high.
"	70	1·500	0·2312	10·7500	76·11	D♯
"	119	2·875	0·7375	5·7500	228·07	A♯
"	115	1·500	0·7500	6·3750	304·44	D♯
"	46	1·500	0·4580	3·9370	512·00	C
"	319	2·250	0·6250	13·5620	80·63	E
4 C I T	64	1·625	0·4395	5·7500	215·27	A
Cast Iron.	116	1·875	0·4000	10·8125	95·89	G
"	120	1·875	0·4000	10·8125	101·59	G♯

Ringing Bells.—The following formulæ are deduced from about one hundred different bells, of from 10 to 5000 pounds; with the assistance of the preceding experiments. Letters denote

W=weight of the bell in pounds avoirdupois.

D=diameter of the bell at the mouth in inches.

S=thickness of the sound bow in inches.

N=number of vibrations per second, corresponding with the key note of the bell, and to be found in the preceding table I.

K=from 0·07 to 0·08, or a co-efficient expressing the relative thickness of sound bow to the diameter of the bell. In peals of bells, the sound bow is generally S=0·08D for the triple, and S=0·07D for the tenor; the intermediate bells in the peal having the intermediate proportions of sound bow. The object of this is to make the *gravity* of tone in the triple approach that in the tenor.

Formulæ for Ringing Bells.

$$W = 0{\cdot}25\, D^2 S \quad . \quad . \quad . \quad (1)$$

$$W = \frac{D^4 n}{232000} \quad . \quad . \quad . \quad (2)$$

$$W = 0{\cdot}25\, D^3 k \quad . \quad . \quad . \quad (3)$$

$$n = 58000\,\frac{S}{D^2} \quad . \quad . \quad . \quad (4)$$

$$n = 232000\,\frac{W}{D^4} \quad . \quad . \quad . \quad (5)$$

$$n = 58000\,\frac{k}{D} \quad . \quad . \quad . \quad (6)$$

$$k = \frac{S}{D} \quad . \quad . \quad . \quad . \quad (7)$$

$$k = \frac{4w}{D^3} \quad . \quad . \quad . \quad . \quad (8)$$

$$D = 2\sqrt{\frac{W}{S}} \quad . \quad . \quad . \quad (9)$$

$$D = \sqrt[3]{\frac{4W}{k}} \quad . \quad . \quad . \quad . \quad (10)$$

$$D = 240{\cdot}83\sqrt{\frac{S}{n}} \quad . \quad . \quad (11)$$

$$D = 21{\cdot}947\sqrt[4]{\frac{W}{n}} \quad . \quad . \quad . \quad (12)$$

$$D = 58000\,\frac{k}{n} \quad . \quad . \quad . \quad (13)$$

$$S = \frac{n\,D^2}{58000} \quad . \quad . \quad . \quad (14)$$

$$S = \frac{4\,W}{D^2} \quad . \quad . \quad . \quad . \quad (15)$$

$$S = k\,D \quad . \quad . \quad . \quad . \quad (16)$$

Example.—It is required to construct a peal of eight bells in the key of D. Required the diameter, sound bow, and weight of each bell?

Make a table with seven columns like table IV., note down the key notes and number of vibrations for each bell from table I.

The values of k being assumed, calculate the diameters of the bells from formula 13, in which $k=0{\cdot}07$, and $n=71{\cdot}84$ for the tenor.

$$D = 58000\,\frac{0{\cdot}07}{71{\cdot}84} = 56{\cdot}5 \text{ inches diameter.}$$

Thickness of the sound bow will be found by formula 16, in which $k=0{\cdot}07$, and $D=56{\cdot}5$ for the tenor.

$$s = 0{\cdot}07 \times 56{\cdot}5 = 3{\cdot}955 \text{ inches, thickness of sound bow.}$$

Find the weight of the tenor by formula 1, in which $D=56{\cdot}5$ and $s=3{\cdot}955$ inches.

$$w = 0{\cdot}25 \times 56{\cdot}5^2 \times 3{\cdot}955 = 3156 \text{ pounds.}$$

These are the dimensions and weight of the tenor; proceed in a similar way with the rest of the bells, and note the results in the table.

TABLE IV.—*Peal of Eight Bells.*

Bells.	Key note.	n	k	S	D	W
Tenor.	D	71·84	0·070	3·95	56·5	3156
2d.	E	80·64	0·071	3·62	51·1	2366
3d.	F♯	90·51	0·072	3·32	46·1	1765
4th.	G	95·89	0·073	3·22	44·2	1575
5th.	A	107·63	0·075	3·08	40·5	1262
6th.	B	120·82	0·077	2·85	37·0	976
7th.	C♯	135·58	0·079	2·67	33·8	763
Triple.	D	143·68	0·080	2·58	32·3	673

To Construct a Bell.—When a bell is to be constructed, we generally have the weight or key note given by contract, the diameter and sound bow are calculated by the preceding formulæ and examples, and then ready to proceed with the construction.

The diameter of the bell at the mouth, is divided into 10 equal parts, called strokes, which then is the scale and measurement for the construction. Make a decimal scale, as shown on plate VII.

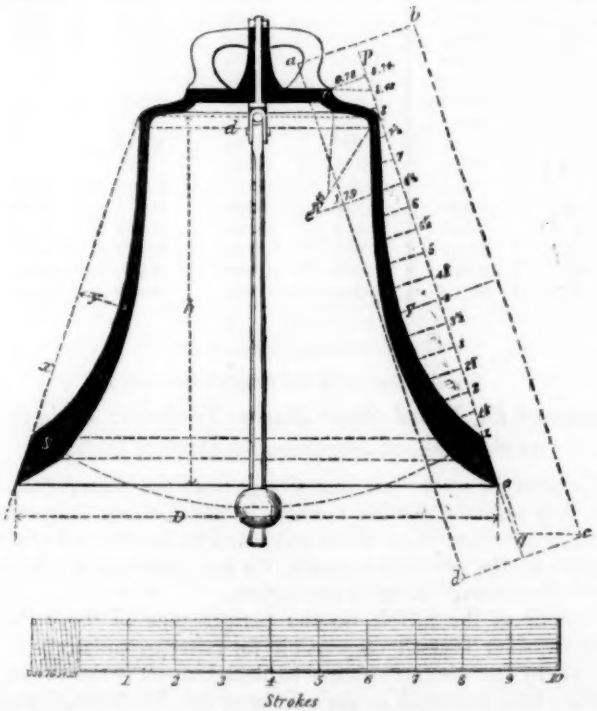
The section of a bell is generally laid out on a piece of board represented by the dotted lines a, b, c, d, which then is cut out and used for turning up the mould for the bell. The board should be about 11 strokes long, and 2·5 strokes wide. Through the centre of the board draw the line p, q, parallel to b, c,—bisect the line p, q, and set four (4) strokes from the bisecting point towards each end; divide the strokes into halves, and number them as shown on the accompanying drawing. Through each division draw lines at right angles to p, q, set off the corresponding ordinates y expressed in strokes, Table V., and join them by a curve-line, which then will be the centre of thickness of metal in the bell.

In the end of the first ordinate, as a centre, draw a circle with a diameter equal to the desired thickness of the sound bow, which should be

from 0·7 to 0·8 strokes. At every succeeding ordinate draw a circle with a diameter noted in Table V; for instance, if the thickness of the sound bow is $4\frac{1}{2}$ inches, then the thickness of metal or diameter is the circle at the third ordinate will be $4{\cdot}5 \times 0{\cdot}474 = 2{\cdot}133$ inches; but if the sound bow is 0·7, 0·75 or 0·3 strokes, the thickness of metal at the third ordinate will be 0·331, 0·355, or 0·379 strokes. When all the thicknesses are thus drawn, draw the two lines tangenting the circles on each side of the centre line of the metal. From the point *o*, draw the tangents to the sound bow; the line *o*·1 should not quite tangent, but leave a moulding about 0·02 strokes, as represented by the drawing. Prolong the $6\frac{1}{2}$ ordinate, and set off 1·79 strokes to *e*, which then is the centre for the curve on the top, draw the arc through the centre of the small circle at the 8th ordinate; join *e*, 8, set off from *e*, 0·46 strokes to the centre for the inside curve at the top.

Thickness of metal of the top should be 0·3 the sound bow at 8, and 0·333 at *r*.

Draw the ordinate at 8·74, set off 0·78 to *r*, join *r* and the abscissa 8·48, and prolong the line through *r*; then finish the drawing as shown on the plate.



When the board is cut out and ready for turning the mould, it must be carefully set, so that the outside diameter of the crown will be half the diameter of the mouth of the bell.

Should the constructor desire to make the bell lower in proportion to the diameter, he can do so by shortening the radius for the top of the crown, or lowering the crown; though not lower than to the seventh ordinate, which only affects the *continuation* of the *sound*. But whatever height chosen, it is necessary to maintain the diameter of the abscissa at 7·9 strokes, equal to half the diameter of the mouth of the bell, or to maintain the same position of the board to the axis of the bell, in order to attain the *maximum quality of tone*.

Clapper.—The weight of the clapper should be from one-fortieth to one-fiftieth the weight of the bell; the small bells take the largest clapper, and vice versa.

Bell Metal.—Thirty pounds of tin to one hundred pounds of copper is a good proportion.

TABLE V.

Abscissa. x	Ordinate. y	Thickness of Metal.			
		$S=1$	$S=0{\cdot}07$ D	$S=0{\cdot}75$ D.	$S=0{\cdot}08$ D.
1	0·4142	1	0·700	0.750	0·800
1½	0·686	0·800	0·560	0·600	0·640
2	0·867	0·653	0·459	0·490	0·522
2½	0·974	0·547	0·382	0·410	0·437
3	1·025	0·474	0·331	0·355	0·379
3½	1·030	0·423	0·295	0·317	0·338
4	1·000	0·380	0·266	0·285	0·304
4½	0·955	0·351	0·245	0·263	0·281
5	0·875	0·327	0·228	0·245	0·261
5½	0·775	0·301	0·211	0·226	0·241
6	0·665	0·291	0·203	0·218	0·233
6½	0·530	0·286	0·200	0·214	0·228
7	0·390	0·279	0·195	0·209	0·223
7½	0·235	0·272	0·190	0·204	0·217
8	0·075	0·267	0·186	0·200	0·213
9·74	0·78	0·333	0·283	0·250	0·266

For the Journal of the Franklin Institute.

Performance of the United States Steamer Powhatan; Reply to Remarks in the Nautical Magazine, for October, 1855.

Having been for some time past absent from the United States, it was not until very recently that the remarks in the *Nautical Magazine* of October last, in reference to an article published in the *Journal of the Franklin Institute* of the preceding month, on the performance of the U. S. Steamer "*Powhatan*," came to our notice.

The author of the article on the performance of the "*Powhatan*," does not consider himself responsible for misrepresentations or false inferences of any one who may choose to place himself in the august position of a critic; but, inasmuch as the editors of the *Nautical Magazine* have fallen into several grave errors, we take the liberty here of referring to some of them, without having, however, any disposition to enter a lengthy discussion of the subject; for there is no doubt in our own mind that any disinterested person, competent to judge, cannot come to the same

conclusion that the editors of the *Nautical Magazine* have, in reference to the "*Powhatan.*"

First, then, they say: "It is this *difference* of *construction* that has rendered nearly all the past efforts of naval constructors abortive in this country, which engineers seldom think of."

This is certainly very gratifying information, and I have not the slightest doubt but that *engineers* will feel truly thankful for having their attention called to the matter. The inference is obvious: that *engineers* were not before aware why a ship of inferior model could not attain the same speed, with an equal expenditure of power, other things remaining the same, as a ship of superior model! But listen again. They say, "it is the model and disbursement of materials, which make the *difference* of *construction*, growing out of a mistaken notion of the laws of resistance." Now, we would like to inquire if "the model and disbursement of materials" did not make a difference in the construction of a ship, what would? But, it does not appear quite so conclusive to our mind, that "the model and disbursement of materials" of a man of war, are occasioned by a "a mistaken notion of the laws of resistance." A mere *ipse dixit* on this point does not strike us to be very good evidence. We do not pretend to say, however, that the model of the "*Powhatan*" could not be improved, but until we meet with a war steamer that is capable of attaining the same speed that the "*Powhatan*" has attained, and is as strongly built, we are willing to take her for sea-going purposes, notwithstanding the abortive efforts of naval constructors in this country. The truth is, too much is expected of the steamers of the navy. They are expected to be swift steamers, fast sailers; to consume much less coal than is required for a merchant steamer of the same size; to carry a large armament and sufficient coal for long voyages; to outrun all merchant vessels they meet; to never have any accidents to occur to their machinery. In other words, to perform miracles; and if they fail in any one of these particulars, they are in consequence denominated abortions.

Again, we quote. They say "we have a new feature presented by this writer—he would call attention to the *masts*, *spars*, &c., as disqualifying the vessel from acquiring the same facility of movement that a merchant vessel would acquire."

Such was certainly the intention of the writer, and he has no reason, from any thing that has subsequently come to his notice, to change his mind. We suppose the editors of the *Nautical Magazine* are aware, that the time sail can be set on a side wheel steamer at sea, compared with her total running time, is very small, and that, when going head to wind, the resistance of the masts, spars, rigging, etc., necessarily prevent her from attaining the same speed, every thing else remaining unaltered, that she would attain without them. This resistance is considered in the merchant service more than sufficient to counterbalance any advantage desirable from the sails in case of fair winds; for which reason the masts and spars are reduced to a minimum for safety, should the machinery become disabled.

Once more. Referring to the average speed of 10·63 knots the hour, they say, "it is plain to every *practical mind*, that this vessel has done her best in a smooth sea and with a fair wind, and that she has due credit for it."

In referring to the abstract log, we remark that the sea was *not* smooth, but that it was light during the first day, and for the remainder of the time it was moderate. Leaving this, however, out of the question, we cannot see *why* it is plain to every *practical mind*, that this vessel did her best. If a little more information had been given in the *Nautical Magazine*, and fewer assertions, it strikes us that it might have been followed by beneficial results, even to the *practical mind*.

We take it upon ourselves to say that our convictions are not in accordance with those of the Editors of the *Nautical Magazine*, and that this vessel did *not* do her best. Our reasons for asserting this are the following:—

It must be manifest to any one, that when a steamer like the "*Powhatan*" does her best, it must be under the most favorable circumstances of wind and sea, with all the sail set she is capable of carrying, and the engines worked up to their maximum power. Such was not the case with the "*Powhatan;*" for the quantity of coal allowed to be consumed per day in the boilers of the steamers belonging to the navy, is regulated by the captain, and he accordingly directs more or less to be burned, as he desires the speed of the ship to be increased or diminished; taking advantage always of fair winds to reduce the coal to a minimum, unless there be an object to make a passage within a certain time. In the case in question, the quantity of coal consumed was 45·59 tons per day, of so inferior quality that it gave an evaporation of only 4·07 lbs. of water per pound of coal. Now, as the boilers of the "*Powhatan*," as stated in the article on her performance, evaporate 2½ lbs. more water than this, per pound of coal, it follows that had the coal been of a good quality an equal amount of power would have been secured by the consumption of 28·24 tons of coal per day.

We see that the resistance of the ship was reduced to such an extent by the sails, *i. e.*, the engines were relieved to such an extent that this amount of coal propelled her at the rate of 10·63 knots per hour. Now, then, inasmuch as the wind was on the quarter, increasing the speed of the ship from 10·63 knots to 12·8 knots could not sensibly reduce its effect on the sails; and assuming the power to increase as the cube of the velocity, without going into any minute calculations, we have

$$10{\cdot}63^3 : 12{\cdot}8^3 : : 28{\cdot}24 : 49{\cdot}3,$$

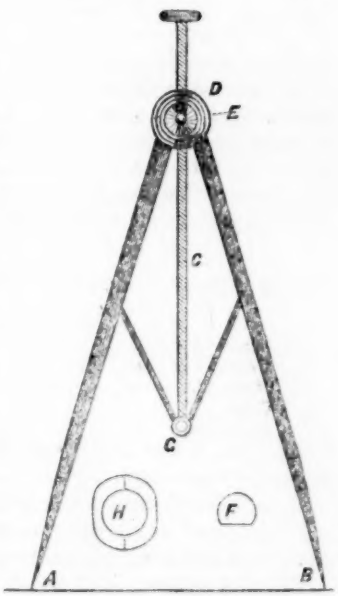
the number of tons of coal required to propel her at the rate of 12·8 knots per hour with the sails set, as in the case under consideration. The boilers of the "*Powhatan*" are capable of, and have consumed coal at the rate of 75 tons per day, (for the truth of which we respectfully refer the skeptical to her log books.) If she had consumed this amount of coal in the above case, the power would have been increased 52·3 per cent. over what would have been required to propel her at the rate of 12·8 knots, which we fancy will be conceded by any disinterested person to be quite sufficient to balance any assistance derivable from the small amount of sail set. Hence we have no hesitation in repeating, that with an unlimited supply of good coal, with a mean draft of 17 feet 9 inches, in smooth water, she is capable of attaining a speed of 12·8 knots the hour without the assistance of sails.

The advice given in the conclusion of the remarks in the *Nautical Magazine*, we consider entirely gratuitous. Had we deemed it necessary for the elucidation of the subject, the resistance of the ship could have been obtained without the advice of any one. We beg leave also to say, that if the Editors of the *Nautical Magazine* choose to give credit to any ship for having moved faster than the instrument that is propelling her, it is no fault of ours, but it occurs to us that it reflects no very great credit on those who chronicled such an occurrence. K.

---

*Description of Gover's Indicating Compasses.**

The following description of an improvement in compasses has been forwarded to us by the designer, Mr. H. C. Gover, of London.



"The principle of these compasses is at once seen on reference to the engraving. The points of the compasses, A, B, are extended or contracted by means of the screw C, which works through a box D,* and the nut E. The screw is filed flat on one side, as shown at F, and on the flat surfuce, is marked an index, which at the point D, indicates the distance between the points A B. The screw is attached to the levers at their juncture G, by a swivel, so as to permit them to work round. The legs of the compasses are hollowed out, as shown at H, so that they shut quite close. As the points of the compasses are liable to become sensibly diminished by wear in the course of time, the top-piece D, may be made to screw tightly on, and be from time to time re-adjusted to the index."

* This has been accidentally omitted in the engraving; the letter D, indicates its position.—Ed. M. M.

For the Journal of the Franklin Institute.

On Gas Furnaces. By Charles Schinz.

The intensity or temperature of a fire, depends partly on the composition of the fuel burned, but still more on the quantity of air used for the combustion.

* From the Lond. Mechan. Mag., November, 1855.

To illustrate this, and to estimate the exact amount of the quantity of heat as well as intensity for different fuels, we give the following tables:

TABLE I.

Composition of different kinds of fuel and quantity of heat produced by each of them.

	Composition.			Produces units of heat.		Total units of heat produced.
	Ashes Water and Nitrogen.	Carbon.	Free Hydrogen.	(1 lb. Carbon yielding 14,500 units of heat.)	(1 lb. Hydrogen yielding 62,000 units of heat.)	
Seasoned wood,	0·600	0·394	0·007	5713	434	6147.
Bituminous coal,	0·150	0·815	0·035	11817	2170	13987.
Charcoal,	0·070	0·930		13485		13485.
Coke,	0·150	0·850		12325		12325.
Anthracite.	0·061	0·915	0·0244	13267	1513	14780.

These quantities of heat are produced invariably if all the carbon be burnt into carbonic acid, but if there is a deficiency of oxygen, the carbon produces another compound, which is known under the name of oxide of carbon; and since 1 lb. of carbon furnishes only 2442 units of heat, while 14,500 units of heat are produced if it is burned to carbonic acid, it is evident that the quantity of heat produced from the fuel is diminished in proportion to the quantity of oxide of carbon formed.

TABLE II.

The heat produced from the different kinds of fuel mentioned above, the carbon being burnt only to oxide of carbon, is as follows:

Seasoned wood,	1397	units of heat.
Bituminous coal,	4160	"
Charcoal,	2271	"
Coke,	2075	"
Anthracite,	3747	"

The loss of heat is therefore for each kind of fuel respectively: 77, 70, 83, and 75 per cent.

Though Table II represents the extreme case in which no carbonic acid is formed, and which never occurs in practice, yet it shows that the production of any carbonic oxide is attended by a very serious loss.

The composition of the fuel being known, it is easy to calculate the exact quantities of air required for its combustion; 6 parts of carbon require 8 parts of oxygen to form oxide of carbon, 16 parts of oxygen to form carbonic acid; and 1 part of hydrogen requires 8 parts of oxygen to form water.

In the following table, we give these calculations for the two cases, viz: for the combustion to oxide and to acid of carbon.

TABLE III.

Air required for the combustion of 1 lb. of different fuels.

	For perfect combustion.		For imperfect combustion.	
Seasoned wood,	60·3	cubic feet.	31·6	cubic feet.
Bituminous coal,	133·7	"	85·8	"
Charcoal,	135·1	"	62·9	"
Coke,	123·5	"	61·7	"
Anthracite,	143·6	"	77·1	"

These calculations, however, though theoretically correct, are not practically so, for the following reasons:—

When the fuel lies on the grate in a thin stratum and a large draft of air is supplied, all the carbon contained in the fuel is burned to carbonic acid, but the excess of air that goes through the fuel, causes a loss of heat; and even in the best constructed furnaces, this excess is twice as much as the quantities given in the table.

If the stratum of the fuel is made thick, little or no air escapes unburnt, but in such case it is impossible to avoid the formation of oxide of carbon which escapes combustion, and hence, as made apparent in Table II, an immense loss of the heat is the result.

Notwithstanding the heavy losses thus sustained, thick strata of fuel are made in all cases, where intensity of heat is desirable, and we are going to show now how far this is explained by theory.

A unit of heat is so much heat as is required to raise the temperature of 1 lb. of water one degree Fahrenheit. To raise the temperature of 1 lb. of air one degree, requires less heat, only 0·2377 of that required for 1 lb. of water, and this number is therefore termed the specific heat of air. From this specific heat we may calculate the heat required for a certain volume of air. For one cubic foot of air it is 0·018575, and this we term the capacity for heat of air.

In the following table, we give the specific heat, and the capacity of heat for such gases as we have here to deal with.

TABLE IV.

Specific heat and capacity of heat for different gases.

Atmospheric air,	Specific heat,	0·2377	Capacity of heat	0·018575
Nitrogen gas,	"	0·2440	"	0·018839
Carbonic acid gas,	"	0·2164	"	0·026858
Carbonic oxide gas,	"	0·2479	"	0·019133
Water in the form of vapor,	"	0·4750	"	0·023534

With these figures, which are the result of the most exact and careful experiments, we are enabled to calculate the temperature of any fire, provided we know the composition and the quantity of fuel burnt, and the quantity and quality of the products resulting from that combustion.

It is now apparent, that the temperature of a fire must vary very much, even in one and the same furnace; yet we may distinguish three general cases, viz:—

1st. A perfect combustion with the strictly required quantity of air.

2d. A perfect combustion with twice as much air as is required, which we may consider in practice to be the case, where fires have a good draft and the strata of fuel are thin.

3d. An imperfect combustion, where a part of the fuel (which we may call one-half) escapes, as oxide of carbon.

The following table gives the products of combustion for these three cases.

TABLE V.

	Perfect Combustion.						Carbonic oxide.	Carbonic acid.	Steam	Nitrogen gas.
	Without excess of air.			With excess of air.						
	Carbonic acid.	Steam.	Nitrogen gas.	Carbonic acid.	Steam.	Nitrogen gas.	Excess of air.				
Seasoned wood, lbs.	1·445	0·663	3·706	1·445	0·663	3·706	4·811	0·460	0·722	0·663	2·779
Bituminous coal, lbs.	2·899	0·315	8·212	2·899	0·315	8·212	10·667	0·963	1·449	0·315	6·159
Charcoal, "	3·410	0·	8·300	3·410		8·300	10·819	1·085	1·705		6·225
Coke, "	3·116	0·	7·586	3·116		7·586	9·885	0·991	1·558		5·607
Anthracite,	3·355	0·219	8·821	3·355	0·219	8·821	11·680	1·067	1·677	0·219	6·615

Multiply now these quantities of gas by the specific heat of each, and we obtain their specific heats as produced from 1 lb. of fuel.

Table VI, gives the results.

TABLE. VI.

Specific heat of the gases produced in the combustion of the different fuels.

	Perfect Combustion.		Imperfect combustion.
	Without excess of air.	With excess of air.	
Seasoned wood,	1·532	2·652	1·279
Bituminous coal,	2·781	5·265	2·206
Charcoal,	2·763	5·282	2·156
Coke,	2·525	4·826	1·972
Anthracite,	2·982	5·701	2·346

If we divide now the quantity of heat produced by the fuel as set down in Table I by these figures, we obtain Table VII, showing the temperature of the fire under the aforementioned three circumstances, viz:—

1st. When the air is the exact amount required.

2d. When it is double as much.

3d. When (as we supposed,) one-half of the carbon passes off as oxide of carbon; (the quantity of heat produced by the fuel being then one-half of the quantities noted in Table I, and one-half of the numbers noted in Table II.)

TABLE VII.

Temperatures attained by the different kinds of fuel, under different circumstances.

	Perfect Combustion.		Imperfect. combustion.
	Without excess of air.	With excess of air.	
Well seasoned wood,	4120° Fah.	2318° Fah.	2949° Fah.
Bituminous coal,	5029° "	2653° "	4113° "
Charcoal,	4881° "	2553° "	3770° "
Coke,	4881° "	2554° "	3651° "
Anthracite,	4956° "	2592° "	3949° "

These results are highly important, and can be fully relied upon as long as the conditions on which they are founded, are observed in practice.

Now, the results represented by the first column, are purely theoreti-

cal, and show what may be obtained if the theoretical requirements are satisfied.

The results of the second column are those of practical observation, controlled by the chemical analysis of the gases produced in the combustion.

The results of the third column are, of course, merely imaginary, since a thick layer of fuel may, according to the size of the pieces, the draft, and divers other circumstances, produce more or less heat, and at the same time allow some of the air to escape undecomposed. They are, however, the most favorable that can be obtained under any circumstances, even if the air is introduced by means of a blower.

The figures in the third column, show, likewise, the truth of our previous statement; that in cases where intense heat is required, thick strata of fuel are always made, even though the loss caused by the formation and non-combustion of oxide of carbon is considerable.

In scientific language the cases represented in the 2d and 3d columns come under the head of extensive and intensive firing.

Extensive firing is applied in all cases where the body to be heated requires but a low temperature, as the heating of our dwellings, of steam boilers, and the like; whereas, intensive firing is required in many of the arts, and particularly in metallurgy.

From what precedes, it is evident, that intensive firing is invariably attended with a loss of 40 per cent.; it is therefore used only in such cases, where intensity of heat is required by the nature of the operation.

It is by no means asserted, that there is no loss in extensive firing. It is well known that more heat passes up the chimney than is necessary to produce the draft.

The draft of a chimney involves much greater complication than most persons suppose.

It is not a simple process. The power of the draft is by no means a constant one. It is affected by many causes; for instance, by the state of the atmosphere, by the heat taken up by the chimney, by the greater or lesser absorption of the heat before the gases reach the chimney, and chiefly by the variable quantity of fuel burnt in a given time.

The quantity of power required, is also variable, it being absorbed by the friction the gases undergo, in passing, 1st, through the fuel, 2d, through the flues, and 3d, through the chimney. Now, this friction increases with the square of the velocity of the gases, and the velocity of course increases as well with the quantity of fuel burnt as with the expansion of the gases themselves; so that it is scarcely possible to control the quantity of air supplied by mere calculation, and this quantity must vary almost at every moment.

The draft, however, aside from the causes of irregularity, depends principally upon, 1st, the size of the pieces of fuel, and 2d, the thickness of the stratum on the grate.

To remedy the first cause, the fuel is screened and otherwise prepared so as to render the size of the pieces as uniform as possible, and to remedy the second, has been a subject for study to many inventors. Numerous contrivances have been proposed, but not one sufficiently simple to be adopted. In most of these inventions it was proposed to distribute the fuel continuously on the grate by mechanical means, but the mechanism was

always found to be so complicated as to require too much power, as to be of no practical benefit.

A blast used to furnish a draft, is an improvement upon the chimney. It gives a more constant supply of air, and hence allows the better application and more complete use of the heat; but it does not remedy the inconvenience arising from the variation in the size of the strata of fuel, and these, as we have seen, are not only a change in the quality of the gases of combustion and consequently in the quantity of heat produced, but also the absorption of a variable quantity of the power that supplies the air.

From what we have written we may draw the following conclusions:

1st. The supply of the air to the fuel, is not only cheaper if affected by mechanical means, but also a correction of many of the defects of the power produced by a chimney.

2d. The careful preparation of the fuel, though to a certain degree expensive, is not to be dispensed with, if economy of heat would be attained.

3d. The irregularities in the size of the fuel, is a practical difficulty not yet successfully overcome.

4th. Partly from the later cause, and partly from others hereafter described, the heat theoretically producible from a quantity of fuel, has hitherto never been obtained.

(To be Continued.)

For the Journal of the Franklin Institute.

Trial Trip of the United States Steam Frigate Merrimac.

The recent successful trial trip of this vessel of a week at sea, is of more than usual importance, from the fact that she is the first of five vessels (almost identical in size, and having the same power and armament), now building by the Navy Dapartment, all of which will be in service during the year 1856. The sixth vessel, the *Niagara*, building in New York, is so entirely different from the others, that she will merit a special notice when finished. But to return to the *Merrimac*. She left Boston Harbor, on Monday, the 25th of February, and entered the Chesapeake on Monday, March 3d; having been under full steam all the time, during which she consumed 224 tons of anthracite coal. She has two distinct back action engines, with cylinders 72 inches diameter, 3 feet stroke; each cylinder is placed near to the crank shaft, allowing sufficient room for the crank to turn, and the piston has two rods, which pass beyond the shaft to a cross head, which, at half-stroke, is 7½ feet distant, and from which the connecting rod leads back to the crank shaft, being somewhat similar to those of the English Steamer *Amphion*. There are four boilers known as Martin's Patent, having been arranged and patented by Daniel B. Martin, Esq., Eng. in Chief, U. S. Navy, each being 14 feet wide in front, 11 feet 3 inches long, and 14 feet 3 inches high; each boiler has 4 furnaces below, the arches continuing to the up-take, where the products of combustion return to the front of boiler, between a series of brass vertical tubes, 3 feet 3 inches long, 2 inches exterior diameter,

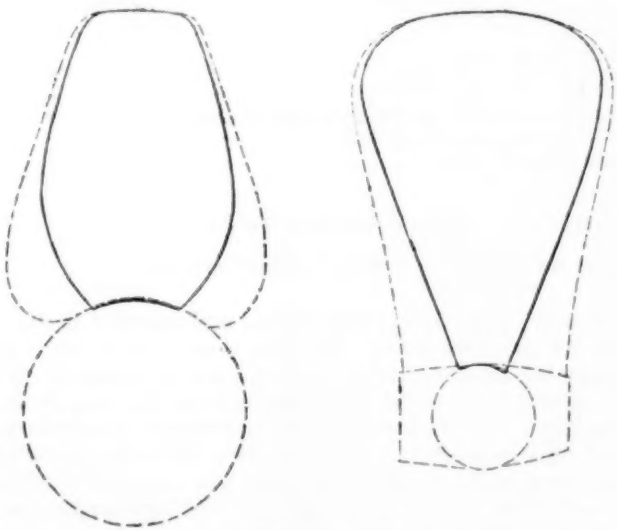
with a clear space between them of $\frac{7}{8}$ of an inch. All four boilers unite at one smoke pipe, which is 8 feet diameter in the clear, and about 70 feet high when hoisted up. The boilers are placed at each side in the vessel, facing the centre, having one fire room 9 feet wide, between which, is common to all.

The total fire surface is,	11,500 sq. feet.
And of grate surface,	330 " "
Weight of water in boilers,	85 tons.

Attached to the steam department, is a pair of small engines for hoisting coal on board, and 2 steam pumps of large size, arranged for pumping out ship, feeding and pumping out boilers, and for fire. These engines have an auxiliary boiler to supply them with steam when necessary. Her bunks will hold 600 tons of coal. The position of the engines is forward of the mainmast, and about 125 feet from the stern post. The propeller is on Griffith's patent, (in this respect differing from all the other vessels, as they have propellers of the usual form,) 17 feet 4 inches diameter, having 2 blades, and weighing about 19,000 lbs.; it is arranged to hoist out, and may be raised from its position with great facility.

Fig. 1, shows two views of one blade of the propeller, the full lines showing the area viewed from the stern, and the dotted lines showing the area viewed at right angles to face of blade.

Fig. 1. Fig. 2.



Scale $\frac{1}{4}$-inch=1 foot.

Fig. 2, shows two similar views of one blade of the propeller for the steamer *Wabash*, building by Merrick & Sons, of this city, being a sister ship to the *Merrimac*, and now very near completion.

Fig. 1, is constructed as a true screw at 17 feet pitch, with an arrangement for altering the pitch of the blades. On the trial trip, the blades were set at a pitch of $29\frac{1}{12}$ feet at their periphery, which gave $25\frac{5}{12}$ feet

at the hub, and 26 $^{2}/_{3}$ feet at centre, between hub and periphery. Mean effective pitch, 25 feet 9½ inches. The hub is a sphere 5 feet diameter.

Fig. 2, is constructed as a true screw of 23 feet pitch. The full area of one blade of fig. 1, is 29 $^{1}/_{2}$ feet, and of fig. 2=38 feet.

On trial trip, the greatest speed under steam made, was going out of Boston Harbor; water, smooth; wind, fair; tide, slack water; average revolutions at the time, 41; when a speed of 9½ knots an hour was obtained. Uuder similar circumstances, against the wind, the speed was 7½ knots. As the speed of the propeller was uniform, the slip in one case, was 10 per cent., and in the other case, 28 per cent.

As this trip was for the particular purpose of testing her machinery, and was of limited duration, no opportunity occurred for obtaining the best speed under canvass and steam; but her officers have no doubt of her ability to make 15 knots.

Her machinery was constructed by Robert P. Parrott, Esq., lessee of the West Point Foundry, New York.

The hull of the *Merrimac* is built in the best manner, and of the best material, from the designs and model of John Lenthall, Esq., Chief of the Bureau of Construction; her dimensions are as follows:

Length over all,	300 feet.		
" from knight-head to taffrail,	281 "		
" from stern post forward of propeller stem at 23 feet draft,	257 "	9 inches.	
Extreme breadth,	51 "	4 "	
Moulded "	50 "	2 "	
Breadth at spar deck,	46 "		
Depth of hold to spar deck,	33 "	8 "	
" " " gun "	26 "	3 "	
Height between berth and gun deck, clear of beams,	5 "	9 "	
" between gun and spar deck,	6 "		
Depth of keel forward,	1 "	9 "	
" " aft,	2 "	3 "	
Deep load line,	23 "		
Area of immersed midship cross section, at 23 feet draft, inclusive of keel,	876 sq. feet.		
Length amidships below berth deck devoted to engines and boilers,	60 feet.		

Her frame is of live oak, sided 13 ins., and moulded 17 ins. at the centre, and 14 ins. at the sides. The floor is solid for its whole length; and the frame is cross strapped on the inside, with iron bars 4½×¾ crossing each other at right angles, and running from the spar deck to the turn of the bilge. These plates or straps are bolted at each frame, and where they cross each other, with 1¼ in. bolts; she is also plated outside at stem and stern, with iron bars of the same size; distance through dead wood at shaft, 20 feet. The after cants are fitted together as high as the berth deck, and bolted edgways. Garboard straiks, 10 ins. thick, and bolted through from side to side, making the seats of floor 4 feet wide. The bottom plank are of white oak 5 ins. thick, and the wales are 7 ins. thick. The berth deck beams are of yellow pine and side 16 ins.; this deck has 7 straiks of clamps 12 ins. wide and 7 ins. thick. The gun deck beams are of yellow pine, sided 17 ins., and moulded 14 ins. The space between the berth and gun decks, is filled at the sides with oak clamps 7 ins. thick; the planks of this deck are 5 ins. thick. There are

38 ports on this deck, and the port sills are 20 ins. deep. The spar deck beams are sided 17 ins., and moulded 13 ins.; deck plank 4 ins. thick; under side of rail 3 feet 8 ins. above deck. Top of hammock rail 5 feet 8 ins., and top of hammocks when stowed, 7 feet 8 ins. above deck. The hull is fastened entirely with copper bolts below, and 1 ft. above deep load line; above that with iron. There has been driven into her hull, 226,740 lbs. of iron, and 139,778 lbs. of copper bolts, from 1½ to ¾-inch diameter. The spar deck is flush, having no obstruction for its length and width, except hatches and smoke pipe. On the gun deck there is the captain's cabin, 30 feet long from the stern, and the galley. On the berth deck aft is the ward room; and then the rooms for the accommodation of the several grades of officers. Forward of these rooms, at each side, is a coal bunk of moderate size, and the balance of the space on this deck is devoted to the crew. On the after orlop deck, are the cockpits; two large bread rooms; 2 sail rooms; 2 store rooms; and 2 state rooms for the use of captain's, and purser's clerks. The forward orlop deck has the general store room; 2 sail rooms, and 2 bread rooms.

She has a round overhanging stern, with quarter galleries, and has the general appearance of a first class man-of-war, without that heavy appearance that has been supposed to belong to vessels of that class.

Spars.—	Lengths.	ft.	in.		Diameters.	ft.	in.
Main mast,		106	5	at deck,		3	6
" topmast,		78	10	greatest,		1	9
" top gallant mast,		34		"		1	0¼
" royal mast, 23; Pole 10		10, 33	10				
From spar deck to main truck,		222	2				
Main yard,		110	4	at slings,		2	1¾
" top sail yard,		83	4	greatest,		1	8½
" top gallant yard,		52	3	"			10¼
" royal yard,		35		"			7
Fore mast,		96	11	"		3	2
" topmast,		72	6	"		1	9
" topgallant mast,		31	3	"		1	0¼
" royal mast, 21 3; Pole, 5,		26	3				
From spar deck to fore truck,		198	9				
Fore yard,		99	4	"		1	11¼
" topsail yard,		75		"		1	6¾
" topgallant yard,		47		"			9⅜
" royal yard,		31	6	"			6½
Mizen mast,		80	8	"		28	
" topmast,		59	3	"		1	3
" topgallant mast,		25	6	"			9
" royal mast, 17 4; Pole, 4,		'21	4				
From spar deck to mizen truck,		170	6				
Cross jack yard,		81		"		1	5¾
Mizen topsail yard,		61		"		1	3
" topgallant yard,		38	2	"			7½
" royal yard,		25	6	"			5
Spanker boom,		60		"		1	1
Gaff,		46		"			8½
Bowsprit,	outboard,	36		"		3	2
Jibboom,		27		"		1	5
Flying jibboom,		23	3	"			10½

The foremast steps on the keelson in the usual way; but as the mainmast comes directly above the screw-shaft, it steps on a solid live oak cross beam, about 10 feet from floor, 3 feet wide, and 15 inches deep,

which is supported from below by two wrought iron columns, 10 inches diameter, rising at each side of shaft. The mizenmast is stepped on the after orlop deck.

Sails.—	sq. ft.		sq. ft.
Fore sail,	4026	Lower studding-sails, each	2856
" topsail,	3692	Fore-topmast studding sails, "	1970
" topgallant-sail,	1488	Main-topmast " " "	2190
" royal,	693	Fore-topgallant " " "	924
Main sail,	5125	Main " " " "	918
" topsail,	4560	Jib,	2425
" topgallant-sail,	1815	Flying jib,	1780
" royal,	815	Fore-spencer,	2193
Spanker,	2185	Main "	2166
Mizen topsail,	2436	All storm-sails,	3785
" topgallant,	975		
" royal,	459		

One suit of sails will cover an area of 58,372 square feet.

Armament.—On spar deck two 10 in. pivot guns, 87 cwt. each, one forward and the other aft; also fourteen 8 inch broadside guns, 63 cwt. each; on gun deck, twenty-four 9 inch broadside guns, 67 cwt. each. Total weight of forty guns, 133 tons, exclusive of carriages. They are all intended for hollow shot and shells.

Her crew will consist of 600 men, exclusive of officers. On the trial trip she easily made under steam and sail, 15 knots per hour, and 9½ knots under steam alone in smooth water, having a full complement of men, stores, &c., on board, and 600 tons of coal. When it is considered that this vessel is 700 tons larger than any of the Collins' steamers, is 6 feet wider, and draws 2 feet more water, and that she has but a little more than half the power, her performance is one with which the Navy Department may well be pleased. B.

---

*New Ornamental Castings.**

Works for the prosecution of an entirely new branch of industry have been opened by Mr. Chance, about five miles from Birmingham—the manufacture of architectural decorations and adjuncts in basalt. The ragstone of the neighborhood is melted and cast in hot moulds, and cornices, doorheads, and other architectural enrichments are produced, of very lasting quality. When cast in cold moulds, a glassy lava, known as obsidian, is produced—an interesting fact in a geological point of view.—*Builder.*

In support of the probability of an extension of this new branch of industry, we may mention that operations are now going on at Ordnance Wharf, Rotherhithe (the works of the Colonial Gold Company), where furnaces have been erected for the reduction of gold quartz by direct fusion, under the patent of Mr. Charles Low, late of Swansea. The quartz thus treated is first crushed moderately small, then calcined or roasted, and afterwards fused with a mixture of fluorspar, lime, and oxide of iron, which liquefying agents combine with the silica, and render the matrix perfectly fluid. The primary object is to liberate the gold found by analysis to exist in the quartz, the particles depositing in a bed, or

* From the Lond. Mech. Mag., Jan., 1856.

bath, of molten lead at the bottom of the furnace; but the fused mass run off as refuse is capable of being cast into iron moulds, and will form ornamental bricks, or blocks of stone, of lasting quality and great beauty, which practical use of the refuse will materially lessen the cost of the manipulation. The metallic alloy at the bottom of the furnace is to be subjected to direct cupellation for the gold produce, the result of which, as an experiment, is watched with considerable interest by scientific men.

For the Journal of the Franklin Institute.

Particulars of the Steamer Canadian.

Hull built by Wm. Denny & Brothers. Machinery by Tilloch & Denny, Dumberton, Scotland. Intended service, Liverpool to Montreal.

HULL.—

Length on deck, from fore part of stem to after part of stern post, above the spar deck,		277 feet	2 inches.
Breadth of beam at midship section,		35 "	
Depth of hold,		23 "	
" " to spar deck,		30 "	
Draft of water at load line,		18 "	
Tonnage, { engine room, 719 / hull, 1045 }	1764.		
Contents of bunkers in tons of coal,	700.		
Masts and rig,	Barque.		

ENGINES.—Vertical direct.

Diameter of cylinders,			62 inches.
Length of stroke,		3 feet	6 "
Maximum pressure of steam in pounds,	12.		
Cut-off,	None.		
Maximum revolutions per minute,	46.		

BOILERS.—Two—Horizontal Tubular—fired at both ends.

Length of boilers,		18 feet	10 inches.
Breadth "		9 "	9 "
Height " exclusive of steam chimney,		14 "	3 "
Number of furnaces,	3 in each end of each boiler.		
Breadth of "		2 "	7 "
Length of grate bars,		6 "	6 "
Number of tubes,	366 in each boiler.		
Internal diameter of tubes,			3¼ "
Length of tubes,		6 "	6 "
Diameter of smoke pipes,		4 "	10 "
Height " "		48 "	
Description of coal,	Bituminous.		
Combustion,	Natural draft.		
Consumption of coal per hour,	30 tons.		

PROPELLER.—

Diameter of screw,		16 feet.	
Length of blades,		5 "	8 inches.
Pitch of screw,		25 "	
Number of blades,	2.		

Remarks.—Frame of wrought iron plates, 16 courses 1 to $\frac{7}{8}$ths thick. Floors (Z) *moulded* 6, *sided* $\frac{1}{2}$ by $3\frac{5}{8}$ flanch. Distance of frames apart *at centres* 12 and 15. Floors are 27 inches deep over keel. Rivets $\frac{3}{4}$, and $\frac{7}{8}$, and 4 ins. apart. Double and abut riveted. Has 2 side keelsons $7\frac{1}{2}$ ins. deep by $1\frac{5}{8}$ thick, ⊥ flanches 6 ins. C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer Vanderbilt.

Hull built by I. Simonson. Machinery by Allaire Works, New York. Intended service, New York to Liverpool.

HULL.—

Length on deck, from fore part of stem to after part of stern post above the spar deck,	331 feet.	
Breadth of beam at midship section, (moulded,)	47 "	6 inches.
Depth of hold,	24 "	6 "
" " to spar deck,	32 "	6 "
Length of engine and boiler space,	114 "	
Draft of water at load line,	19 "	
Tunnage (carpenter's),	5000.	
Contents of bunkers in tons of coal,	1200.	
Masts and rig—topsail schooner.		

ENGINES.—Vertical beam.

Diameter of cylinders,		90 inches.
Length of stroke,	12 feet.	

BOILERS.—Four—horizontal return tubular.

Length of boilers,	28 "	6 "
Breadth "	13 "	11 "
Height " exclusive of steam chimney,	13 "	6 "
Number of furnaces,	8 in each boiler.	
Length of grate bars, average	6 "	6 "
Internal diameter of tubes,		3 "
Diameter of smoke pipes,	8 "	8 "
Height "	40 "	
Description of coal,	Bituminous.	
Combustion,	Natural draft.	

PADDLE WHEELS.—

Diameter,	41 feet.	
Length of blades,	10 "	
Depth,		24 inches.
Number,	36.	

Remarks.—Floor timbers at throats, *moulded* 21 ins., *sided* 15 inches. Distance of frames apart *at centres*, 32 ins. Hull strapped with diagonal and double laid iron braces, 320 of them $5 \times \frac{7}{8}$. Floor filled in solid, and bolted fore and aft. C. H. H.

---

*The Cosmorama Stereoscope.**

This is a modification of the beautiful instrument invented by Sir David Brewster. The improvement consists in employing, instead of the two small semi-lenses, one large one, which is rendered stereoscopic by cutting an ordinary plano-convex lens in half, removing more or less of the opposite outer diameter, and then transposing the pieces so that the original centre of the lens becomes the two sides, and the outer edges come together. The advantages obtained by this instrument is an increased facility for viewing as one the double pictures: only one adjustment is necessary for all sights, namely, increasing or diminishing the distance between the line and the double pictures. By using larger lenses of proper focal length, pictures of any dimensions may be viewed stereoscopically.

* From the Lond. Mech. Mag., Jan., 1856.

FRANKLIN INSTITUTE.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on J. D. Dale's Machine for Working Wood Mouldings.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "Improvements in the Machine for working Wood Mouldings," invented by Mr. John D. Dale, of Philadelphia, Pennsylvania.—REPORT:

That, the invention and improvement consists in arranging a series of moulding cutters, or plane bits, side by side, along the length of, and around the axis of rotation, and securing them between adjustable cutter-heads, capable of being moved to conform with the size of the moulding designed to be worked. Combining therewith rotating saws, or their equivalents, for slitting or separating the several mouldings at the same operation.

The improved part of the machine may be described, as the rotating cutter-head, and the mouth pieces.

The cutter-head consists in a series of circular disks about 6 or 7 inches diameter, arranged upon a horizontal shaft, the two outer ones secured thereto near to the ends, and to four horizontal guide rods placed equidistant, and near to the peripheries; all the interior disks have horizontal motion upon the shaft and the guide rods.

These guide rods have cogs on their inner surfaces, and mesh in gear with the threads of screws formed on the periphery of hubs, surrounding the shaft, and capable of moving around and laterally over the same, being confined in concentric spaces formed in the disk, by means of plates on either side, in such manner as to enable the hubs to be turned, whereby the screws on the peripheries operate on the cogs of the guide bars, and move the disks towards each other, to gripe and hold the cutters inserted in grooves between them.

The stationary and movable disks have each one or more teeth, acting as saws, secured on their peripheries, of a sufficient projection beyond the moulding bits, for slitting the plank to the required widths of the mouldings.

The horizontal shaft with its rotating stock of plane irons, is mounted in boxes of a suitable form provided with the usual fixtures for feeding, guiding, and sustaining the plank. And upon each end of the shaft is hung an arm, having a bar with a slot in it, extending nearly its whole length; to the under surface of which bar, are secured a series of plates of hard wood, by means of screw bolts passing through the slots, so that the plates can be shifted at pleasure for adjustment. There is one of these plates for each set of moulding cutters, viz: for each division of the rotating stock, and the forward edge of each plate respectively fits close and accurately to the contoured edge of the cutters, being formed by shifting or pressing them forward upon the cutters sufficiently for the purpose, when the head is in operation.

This part of the improvement is called the mouth-piece, its advantages

being in all respects like to the same parts of the plane preventing the skelfing or splintering of the plank by the cutters during the planing of the moulding.

It will thus be seen, that any number of moulding bits, may be arranged around, and secured side by side between the disks, on the same shaft, with slitting teeth or saws for dividing each set; or the slitting saws upon the inside disks may be removed, and the whole or any required width of moulding, number of members, &c., desired, may be worked out at one and the same passage of the plank through the machine. It appears to the Committee to work well, with or against the grain of the wood, and with speed; the time occupied in working the whole width of a board into a number of mouldings being about equal to that of a single moulding in machines heretofore in use.

The rotating head of the machine seen in operation by the Sub-Committee, had but a single cutter to each moulding, and the dividing saw tooth; yet the work produced was sufficiently smooth for a distance of 15 to 20 feet from the eye, and in the opinion of the Committee, if two or more bits were to be used on each surface to be planed, the work would be sufficiently smooth for the usual purposes near to the eye. But for such use Mr. Dale finds it more economical to finish the mouldings by planing off a few shavings by hand.

The improvement appears to be new, and of sufficiently useful importance to the arts to warrant the Committee in recommending it to the Board of Managers for the award of the Scott Legacy Premium.

These improvements of Mr. Dale, were patented on the fourth day of January, 1853; and on the tenth day of October, 1854.

By order of the Committee,

WM. HAMILTON, *Actuary.*

Philadelphia, January 10th, 1856.

Description of Cuts by the Inventor.

Figure 1, represents a perspective view of the improved machine. Fig. 2, is a section of the rotating cutter-heads, and parts for moving and securing the same on their shaft. A are the cutter-head disks or circular plates, with grooves, in and between which the cutters B, are secured. C, are the teeth secured to the disks or circular plates, for slitting the board or plank to the required width of the mouldings, after the manner of a circular saw. D, is the mouth-piece frame, so suspended and secured in relation to the cutters, as to enable the contoured edges of the mouth-piece, corresponding in every respect with the form of the cutters to press upon, the edge of the plank being moulded immediately next where the cutting is being performed, so as to prevent skelfing or splintering of the plank by the cutters during their cutting process. E, are the cogged bars for moving the disks and securing the cutters in the grooves between them. F, are the hubs having screw threads on their peripheries which mesh in gear, with the caps of the bars E, and being secured between plates secured to the disks or circular plates A, in such a manner as to enable the latter to be moved by the turning of the hubs. G, is the lower cutter head shaft for planing the lower surface of the plank. H, are the feed rollers. I are the ends of a series of mouldings in the act of being planed to the required form, by the cutters B, and separated by the teeth C.

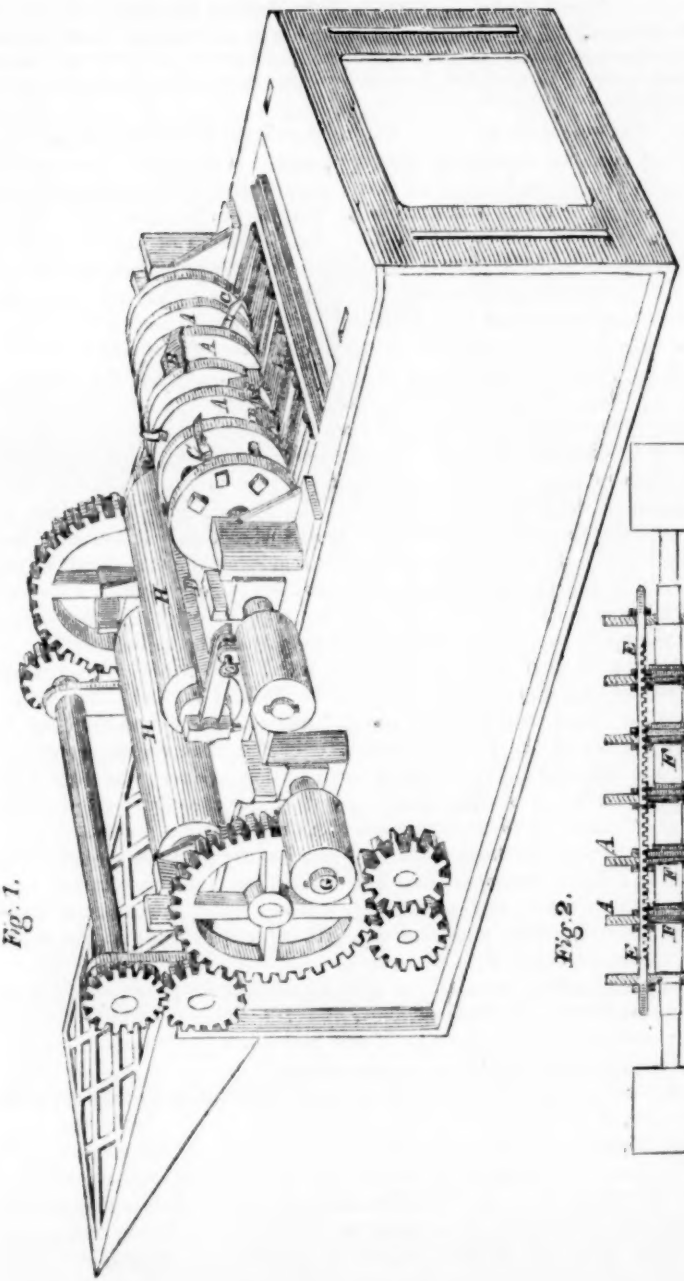


Fig. 1.

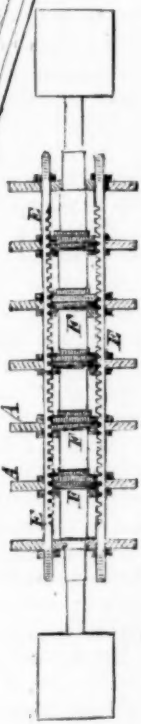


Fig. 2.

Report on G. T. Parry's Anti-Friction Bearing.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "Conical Anti-Friction Bearings," invented by Mr. G. T. Parry, of Philadelphia, Pennsylvania.—REPORT:

That, the object of the invention is to reduce the friction incident to revolving surfaces sustaining pressure, and it is intended to be applied principally to turn-tables, and to shafts transmitting end pressure, as propeller shafting, or vertical shafts whose weight is to be supported. It consists of a series of rollers shaped like double frustra of cones united at their bases, and therefore larger in diameter at some point between the extremes, to which the rollers taper uniformly. These rollers are interposed between two flat surfaces indented by grooves opposite each other; which grooves are shaped so that the extreme diameter of the rollers touches them at the deepest point only; and very nearly touches at the extremes, thus permitting a slight rocking motion.

It has been customary to support turn-tables on conical rollers, having the longest diameter furthest from the centre of revolution, and to restrain them in their tendency to separate by rods arranged as radial axes; but so far as the Committee is aware, Mr. Parry's idea of adding the outer cone for the same purpose is original with him. It has also been proposed to construct bearing collars for receiving the end thrust of propeller shafting, with one-ended cones as above described. This plan, however, is open to serious objection on account of the friction due to the tendency to separate coming on the collars of the radial axis.

Experiments made on two steamers, fitted with Mr. Parry's arrangement, one a propeller of 700 tons, the "*North Carolina*," the other a tow boat of small size, the "*Cushing*," showed the Committee that the gain by the use of Parry's arrangement over the plain collars, or in other words, the substitution of a rolling for a sliding surface, was from 6 to 8 per cent., when the sliding surfaces were kept constantly oiled. This result was naturally to be expected. As regards the durability of the apparatus, the reports from various boats having it in use are somewhat conflicting; but it appears generally established that the double cones when properly made and attended to are not liable to lose their shape, and that their operation is satisfactory. As regards turn-tables, the reports are of the same character.

The Committee are decidedly of opinion that the invention of Mr. Parry, forms an improvement to turn-tables, by diminishing the friction of revolution; and believe it to be one of the best known methods of supporting superincumbent weight revolving slowly.

In the case of propeller shafting where revolution is very rapid and continuous, they believe it to be a great improvement over the use of rubbing surfaces or plain collars; and although they are not prepared, from want of due experience in the durability of the apparatus, to say that it might supersede those well established methods of receiving thrust, they consider its advantages so marked as to warrant its use in conjunction with those methods, so that the gain resulting from diminished friction should be realized so long as the apparatus remains in working order.

It is proper to say that by the mode of construction adopted by Mr. Par-

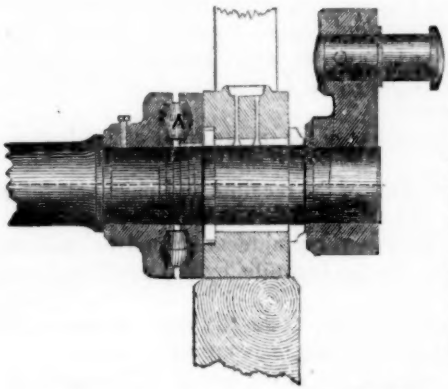
ry, the replacing of rollers when worn is easy, and can be effected without loss of time; while their first cost is trifling, and hence the expense due to wear cannot be an item of much importance to sea-going steamers.

The Committee, therefore, hope that the invention may be generally introduced for the purposes designed, believing it to be an improvement over other methods in use.

By order of the Committee,

Philadelphia, January 10th, 1856. WM. HAMILTON, *Actuary.*

Fig. 1.



Description of Cuts by the Inventor.

Fig. 1, represents the crank shaft of a propeller, with the box bearing against the pillar block; the rollers A, revolving with the shaft.

Fig 2. View as applied to the U. S. Steamers *Wabash* and *Minnesota;* the dotted lines represent the shaft; D D, rings on shaft for backing; the forward thrust on box, and rollers C.

Fig. 3. Railway turn-table; in this application, the under side of the box rests upon the upright A, supporting the table while it is revolving on rollers; E, wheel to hold up outer end of table.

Fig. 2.

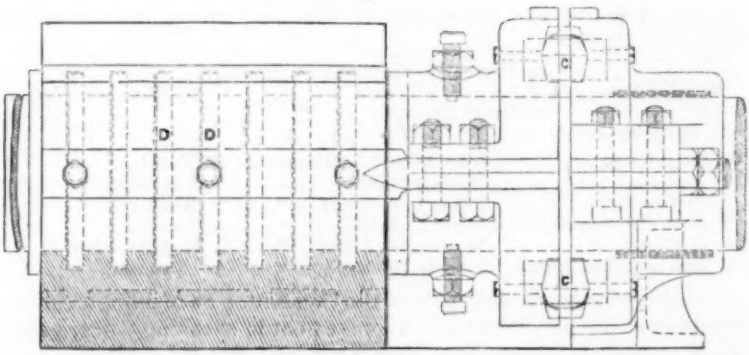
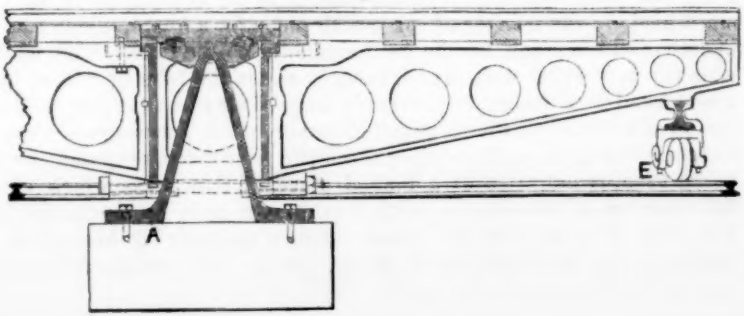


Fig. 3.



Proceedings of the Stated Monthly Meeting, March 20th, 1856.

Thomas S. Stewart, President, pro tem., in the chair.

John F. Frazer, Treasurer.

Dr. John L. Le Conte, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

Letters were read from the Smithsonian Institute, and from Thomas U. Walter, Esq., Washington, D. C.

Donations to the Library were received from the Chemical Society, London; Thomas U. Walter, Washington, D. C.; The Massachusetts Charitable Mechanic's Association, and Daniel Treadwell, Boston, Massachusetts; The Board of Water Commissioners, Detroit, Michigan; The Sunbury and Erie Railroad Company; A. J. Brasier; A. B. Hutton and George M. Conarroe, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of February.

The Board of Managers and Standing Committees reported their minutes.

Resignations of membership in the Institute by (9) gentlemen were read and accepted.

Candidates for membership in the Institute (5) were proposed, and the candidates proposed at the last meeting (8) were duly elected.

The Actuary reported the organization of the Board of Managers, and the following Standing Committees for the ensuing year, by the election of their chairman, and appointing the time for holding their stated meetings, as follows:

Board of Managers,	George W. Conarroe, Chairman, Isaac S. Williams, Owen Evans,	Curators.	2d Wednesday Evening.

Committees.

On the Library,	John Allen, Chairman,	1st Tuesday	"
" Models,	William Smith, "	1st Thursday	"
" Meteorology,	Alfred L. Kennedy, "	2d Monday	"
" Arts and Manufactures,	James C. Booth, "	2d Tuesday	"
" Meetings,	Washington Jones, "	Monday before 3d	
" Min's. & Geo. Spem's,	John L. Le Conte, "	Thursday	"

Washington Jones, chairman of the Committee on Meetings, called the attention of the members to an improvement in speaking tubes, patented by Woolcock & Ostrander of New York, and sent for exhibition by Mr. Peter Rodgers. The improvement consists in the attachment of the signal whistle to the interior of the mouth piece by a hinge, which can be operated with a crank handle on the exterior of the tube. The whistle is made in a metal disk, which entirely closes the tube by resting upon a seat faced with leather, to prevent leakage of air when the tube is blown into to sound the whistle to attract attention, when a message is about to be sent. When two or more pipes terminate near the same point, the one being used, is indicated by a hinged piece of thin brass which covers the aperture of the whistle, until it is thrown over by the issuing air. The disk is opened by the crank when a message is being sent or received, and is closed by a spring, giving less trouble than in the

plan where the whistle is made in a plug, which, when not forgotten, is inserted in the mouth piece by hand.

Also, a new arrangement, by Mr. Kingston Goddard, of curb and snaffle bit, in which one pair of reins, formed of strong catgut, passes through the hollows formed in the middle of the other reins, when the edges are brought together and stitched, to give the leather the usual cylindrical shape. By it, fewer gears are visible, and the curb rein is always near the hand of the rider, ready for emergency. It is submitted by the inventor, to the Committee on Science and Arts for a report upon the new features.

Mr. T. S. Martin exhibited two American watch movements manufactured by Dennison, Howard & Davis, Waltham, Connecticut, one plain, the other full jeweled. They are remarkable as being the first watches ever made wholly by machinery. They combine the principle of the English patent lever, with that of the Swiss watch and detached lever. The power is direct from the main spring, no chain being employed. All the watches (of the same description) correspond, so that any part taken out of one will answer for another.

The manufacturers have expended $100,000, for machinery and means for carrying on their operations. The machine is said to be remarkably ingenious, and finishes the work ready to be put together without extra hand labor.

Mr. Martin also exhibited a bar of the "new metal" Aluminum, together with a salt spoon, mustard spoon, and fork of the same material.

Dr. Rand laid before the meeting several specimens of improvement in Photographs, by Dr. G. Langdell.

Some four years since there were exhibited to the Institute, specimens of photography upon collodion. The pictures produced at that time, were very clearly defined, and effective, so far as accurate gradation of light and shade was desired, but the great contrast between full light and deep shadow gave to all of them a sombre cast, unpleasant in the general effect. In order to remove this defect, many attempts have been made to procure certain tones or tints of color common to the whole picture, so as to decrease the contrasts and give a neutral cast without affecting the gradations of light and shade.

How far these efforts have been successful can be judged from the specimens exhibited by Dr. Langdell. The colors he has selected are shades of orange and brown pink. These colors can be produced separately or any shade of their combination at the pleasure of the operator.

Mr. H. Howson exhibited an improved rattle for policemen, which was patented by James M'Cord, of this City, in November last. The improvement consists in securing the handle to the edge of the ratchet wheel, and at right angles to the axis of the latter, for the purpose of turning down the handle out of the way, thereby rendering the instrument more convenient to carry in the pocket, and for the further purpose of combining a mace and rattle in one instrument.

Mr. Howson also exhibited a model of an improved harvester rake, invented by Samuel Comfort, Jr., of Morrisville, Bucks County, Pennsylvania, for which he is about applying for a patent.

Mr. Howson also exhibited specimens of printing type of a peculiar form, for which a patent for a design was granted to Lawrence Johnson, Esq., of this City, in January last.